

# Current Science

INDIANA UNIVERSITY  
NOVEMBER 1948  
LIBRARY

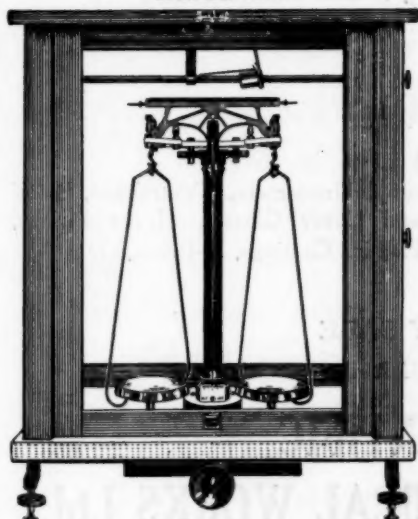
Vol. 17, No. 11

Pages 313-342

JAN 21 1949

## ANALYTICAL BALANCE

MODEL K-1



SENSITIVITY— $\frac{1}{10}$  mg.; 5 divisions throw of pointer for 1 mg.

CAPACITY—200 Grams.

BEAM—5 $\frac{1}{2}$ ", Hard Bronze.

GRADUATIONS—100 divisions, notched, lettered in White against Black. Zero either to Left or at Centre, as desired.

ARRESTMENT—Falling type.

BASE—Marble.

FINISH—Black and Golden lacquer; bright parts nickelled.

## ADAIR, DUTT & Co., Ltd.

(INCORPORATED IN ENGLAND)

LONDON

— CALCUTTA

— BOMBAY

— MADRAS

**"SACWO"**

# **P I**PRECISION INSTRUMENTS

FOR

**Degree Colleges and Research Laboratories**

FOR

**Immediate Delivery**

## **Physics**

Vernier Microscopes, Reading Telescopes, Post Office and Resistance Boxes, Potentiometers, Kohlrausch Bridge, Optical Benches and Bi-Prism Assemblies, Young's Modulus Apparatus, Torsion Apparatus, Sensitive Galvanometers with Telescopes, Tangent Galvanometers, etc., etc.

## **Biology**

Dissecting Microscopes and Magnifiers, Models and Charts.

## **Physiology and Pharmacology**

Recording Drums and Assemblies.

## **Imported Goods**

Microscopes, Haemocytometers, Haemoglobinometers, Centrifuges, Blood Pressure Instruments, Stethoscopes, Slides and Cover Glasses, Hyvac Pumps, Galvanometers, Ammeters and Voltmeters, Replica Gratings, Bi-Prism, etc.

**FOR READY SALE**

*Enquiries solicited*

**THE SCIENTIFIC  
APPARATUS & CHEMICAL WORKS Ltd.**

**CIVIL LINES, A G R A**

**Telephone: 27304**

**Telegram: TECHLAB**

**TO-MORROW'S EQUIPMENT TODAY**

## **SUPAIRCO PLANTS**

*For the Manufacture of*

**LIQUID**

**OXYGEN    NITROGEN    AND    AIR**

Used in

1. Industry
2. Research Institutions

*Manufactured by*

**SUPERIOR AIR PRODUCTS Co.**

**U.S.A.**

*For Further Particulars consult:—*

**RAJ-DER-KAR & CO.**

**Commissariat Building, Hornby Road, Fort  
BOMBAY**

**(SOLE DISTRIBUTORS)**

# IN THE FIELD OF VITAMINS

---



ALEMBIC has contributed a long range of important preparations—reliable, accurate and potent. They are scientifically manufactured, precisely standardized and carefully assayed.

<b>BERVITEX</b>	(Vitamin B1)	Tablets & Injection.
<b>BIVINAL</b>	(Vit. B Complex)	Capsules & Elixir.
<b>CIVINAL</b>	(Vitamin C)	Tablets & Injection.
<b>DIVINAL</b>	(Vitamin D)	Tablets.
<b>KIVINAL</b>	(Vitamin K)	Injection.
<b>NICONIN</b>	(Niacinamide)	Tablets & Injection

---

**ALEMBIC CHEMICAL WORKS CO. LTD., BARODA**



# DAWE

*Precision*

## ELECTRONIC INSTRUMENTS for LABORATORY & FACTORY

PRECISION RESISTERS & CONDENSORS  
FLASH UNITS FOR PHOTOGRAPHY  
BRIDGES & OSCILLATORS  
METERS & INDICATORS  
FREQUENCY AND WAVE FORM INSTRUMENTS  
SIGNAL GENERATORS, STROBOSCOPIC APPARATUS  
MOISTURE METERS, R. F. SOURCES, GAUGES

### PHOTOFLASH

HIGH SPEED FLASH LAMP  
SPECIALLY DEVELOPED FOR  
ACTION PHOTOGRAPHY

PRECISION VARIABLE  
AIR CONDENSOR

*Sole distributors*

**SHREE INDUSTRIAL & COMMERCIAL  
SYNDICATE LTD.**

HEAD OFFICE : 36, MINT RD, FORT - BOMBAY.

BRANCHES: AKOLA, CALCUTTA, DELHI, INDORE, JUBBULPORE & MADRAS

## CURRENT SCIENCE

Only a limited number of copies of the following Special  
Numbers are available

### 1. "Laue Diagrams"

Contributions by : Sir C. V. Raman, Prof. Max von Laue, Sir W. H. Bragg, Prof. W. L. Bragg,  
Prof. P. P. Ewald, Prof. Manne Siegbahn, Prof. Arnold Sommerfeld, Dr. Linus Pauling,  
Prof. C. G. Darwin, Prof. H. Mark, Prof. J. A. Prins, Dr. Samuel K. Allison, Prof. H. A.  
Kramers and Dr. S. Ramaswamy. **Rs. 1-8-0 each**

### 2. "50 Years of Canal Rays"

Contributions by : Prof. B. Venkatesachar, Prof. R. Trautenberg, Dr. R. Dopel, Dr. B.  
Dasannacharya, Dr. Rudolf Ritsch, Prof. E. Ruchardt, Dr. F. W. Aston and Dr. S. D.  
Cockroft. **Rs. 1-8-0 each**

### 3. "Genetics"

Contributions by : Dr. Eileen W. E. Macfarlane, Dr. H. J. Muller, Prof. O. Winge, Prof.  
H. Kihara, Dr. H. B. Frost, Prof. E. B. Babcock, Prof. A. F. Shull, Dr. C. B. Davenport and  
Dr. C. B. Bridges. **Rs. 2 each**

### 4. "Organisers in Animal Development"

Contributions by : Prof. Dr. von O. Mangold, Dr. Eckhard Rotmann, Prof. Dr. von Johannes  
Holtfreter, Prof. Paul Weiss, Dr. Wolfgang Luther, Dr. C. H. Waddington, Prof. Sven  
Horstadius and Dr. C. M. Child. **Rs. 2-8-0 each**

Apply for copies to :

**The Secretary  
Current Science Association  
Bangalore 3 (India)**

## **"BOROSIL"**

### **Neutral Laboratory Glassware**

**Borosil** Reagent Bottles **8** ozs. and **16** ozs. with dust-proof stoppers, now available.

(Narrow mouth and wide mouth)

*All sizes of Neutral bottles manufactured to client's requirements.*

### **Industrial & Engineering Apparatus Co. Ltd.**

Chotani Estates, Proctor Road, Grant Road  
**BOMBAY-7**

*Branch Offices:*

**MADRAS. 53-B. Second Line Beach.**

**NEW DELHI. Pahar Ganj Road, Krishna Market, Near Delhi  
Cloth Mills Depot.**

**MASULIPATAM. Kojjillipet.**

#### **NOW OFFERING :**

- ⊗ **PYE'S** P.O. Box, R. Box, Stop Clock, Elasticity Apparatus and Galvanometer.
- ⊗ **CASSELA'S** Fortins Barometer.
- ⊗ **SALTER'S** Spring balances and weighing scales.
- ⊗ **WELCH** Induction Coils, Vacuum pump, Vacuum tubes, Diffracting Gratings and Charts.
- ⊗ **ENGLISH** Optically worked Mirrors, Lenses and Magnifiers.
- ⊗ **AMERICAN** Latest type of Rheostats.
- ⊗ **ENGLISH** Chemical and Analytical Balances and Weights.
- ⊗ **CHANCES** Hysil glassware.
- ⊗ **WORCESTER** Sillax Dishes and Crucibles.
- ⊗ **TOWERS** Electric Furnaces and Graduated Glassware.
- ⊗ **B. D. H. & JUDEX** Laboratory Chemicals. Also
- ⊗ **DOULTONS** Laboratory Sinks and Buchner Funnels and English or American Museum jars, Soxhlet Apparatus.

All consignments now on Seas to India.

Unique Selection of Imported Scientific Instruments together with  
Our Manufactured and Standardised apparatus in All Branches of  
Science.

**Complete Laboratory Furnishers :**

### **HARGOLAL & SONS**

**THE SCIENCE APPARATUS WORKSHOP**

**PHONE: 173**

**HEAD OFFICE: AMBALA CANTT.**

**Branch Office: 27A, LINGA CHETTY ST., MADRAS**

**Agency Offices at :**

**DELHI, JUBBULPORE, BOMBAY AND HYDERABAD (Dn.)**

## Indian Journal of Dairy Science

A Quarterly Journal Devoted to  
the Publication of original research  
bearing on DAIRY SCIENCE.

Annual Subscription: Rs. 12  
Single Copy: Rs. 3

*For advertisement rates and other  
particulars, apply to*

The Joint Secretaries  
Indian Dairy Science Association  
Indian Dairy Research Institute  
Bangalore

## A Textbook of Bacteriology

BY

DR. N. G. PANDALAI,  
M.D., D.T.M., F.R.C.P.  
Professor, Andhra Medical College

*Watch Publication!*

THE  
BANGALORE PRESS  
Post Box No. 7  
BANGALORE 2

*Specify*  
**B.D.H.**

### LABORATORY CHEMICALS & REAGENTS

Their exceptional reliability and high standard  
of quality are recognised throughout the world.

ORGANIC AND INORGANIC  
FINE CHEMICALS

•  
'ANALAR' REAGENTS

•  
ADSORPTION, OXIDATION-  
REDUCTION & pH INDICATORS

•  
MICROSCOPICAL STAINS AND  
STAINING SOLUTIONS

•  
MICRO-ANALYTICAL REAGENTS

•  
REAGENTS FOR CLINICAL  
ANALYSIS

•  
FINE CHEMICALS for INDUSTRY

**THE BRITISH DRUG HOUSES LTD.**  
POOLE B.D.H. LABORATORY CHEMICALS GROUP ENGLAND

Distributed in India by: BRITISH DRUG HOUSES (INDIA) LTD., P.O. Box 1341, BOMBAY 1. P.O. Box 7882, CALCUTTA 12.

# Some of Our Books on Chemistry

## 1. An Elementary Text-Book of Organic Chemistry

by Dr. D. D. Karve, M.Sc., Ph.D., A.I.I.Sc. A standard text-book for the I.Sc. and the Junior B.Sc. (Pass) courses and also for the Agricultural and the Medical courses of Indian Universities.

Pages 200. Size  $5\frac{1}{2}'' \times 8\frac{1}{2}''$ . 5th Ed. 1946. Rs. 2-12-0

## 2. Chapters in Physical Chemistry

by Mr. B. N. Phadke, B.Sc. (Distinc.), B.Sc. (tech). One of the few Indian books on this subject for the B.Sc. (Pass & Subs.) and B.Sc. (Hons. & Prin.) courses.

Pages 618. Size  $5\frac{1}{2}'' \times 8\frac{1}{2}''$ . 3rd Ed. 1948. Rs. 12-8-0

## 3. Selected Chapters from Modern Inorganic Chemistry

by Dr. K. K. Dole, M.Sc., Ph.D. Useful for the B.Sc. (Prin.) and B.Sc. (Hons.) and M.Sc. courses of Indian Universities.

Pages 332. Size  $5\frac{1}{2}'' \times 8\frac{1}{2}''$ . 1947 Edition. Rs. 8-8-0

## 4. Selected Topics from Organic Chemistry

by Dr. Karve, M.Sc., Ph.D. & Prof. Advani, B.A., M.Sc. Useful for the B.Sc. (Prin.), B.Sc. (Hons.) and M.Sc. courses of Indian Universities.

Pages 424. Size  $5\frac{1}{2}'' \times 8\frac{1}{2}''$ . 2nd Ed. 1947. Rs. 10-0-0

## 5. A Laboratory Hand-Book of Organic Qualitative Analysis and Separations

by Mr. V. S. Kulkarni, M.Sc. For the B.Sc. (Prin. & Subs.) and B.A. (with Chem.) students.

Pages 70. Size  $5\frac{1}{2}'' \times 8\frac{1}{2}''$ . 2nd Ed. 1948. Rs. 1-8-0

## 6. Notes on Inorganic Quantitative Analysis

Part 1st—Single Radicals by Mr. V. L. Pradhan, B.A., B.Sc. For the B.A. and B.Sc. (Subs. & Prin.) students.

Pages 102. Size  $5\frac{1}{2}'' \times 8\frac{1}{2}''$ . 1947 Edition. Rs. 1-14-0

## 7. Notes on Inorganic Quantitative Analysis

Part 2nd—Mixtures, Alloys and Ores by Mr. V. L. Pradhan, B.A., B.Sc. For the B.Sc. (Prin. Chem.) students.

Pages 92. Size  $5\frac{1}{2}'' \times 8\frac{1}{2}''$ . 4th Ed. 1947. Rs. 1-12-0

## 8. Notes on Inorganic Qualitative Analysis of Mixtures of Salts

by Mr. V. L. Pradhan, B.A., B.Sc. For the B.A. and B.Sc. Chemistry students.

Pages 64. Size  $5\frac{1}{2}'' \times 8\frac{1}{2}''$ . 3rd Ed. 1946. Rs. 1-6-0

## 9. Problems in Organic Chemistry for Advanced Students

by Mr. Lele, Mr. Jog. and Prof. Advani. Useful for B.A., B.Sc. and M.Sc. courses.

Pages 102. Size  $5\frac{1}{2}'' \times 8\frac{1}{2}''$ . 1948 Ed. Rs. 2-8-0

## 10. History of Dyes and Dyeing in the Bombay Presidency

by Mr. B. N. Phadke, B.Sc. (distinc.), B.Sc. (tech.), Foreword by Dr. K. Venkataraman and Preface by Mr. Kabbur. (The University of Bombay has awarded "The Ashburner Prize" and has also sanctioned a "Publication Grant" for this book.) Coloured printing throughout. Useful for dyers, calico-printers, textile mills, and the Apprentice course in dyeing, bleaching and allied subjects.

Pages 180. Size:  $7\frac{1}{2}'' \times 10''$ ; 1947 Ed. Rs. 12-0-0

All these Books are Available with Booksellers or with

**DASTANE BROTHERS' HOME SERVICE, LTD.**

456, RAVIWAR PETH, POONA 2

# Current Science

Vol. XVII]

NOVEMBER 1948

[No. 11

	PAGE		PAGE
World's Prospect of Food and Agriculture .. ..	313	New Lamps for Old. B. K. VAIDYA ..	320
Cytogenetics of <i>Nicotiana tabacum</i> var. <i>virii</i> Resistant to the Common Tobacco Mosaic Virus. DONTCHO KOSTOFF ..	315	Tonus in Unstriated Muscle. INDERJIT SINGH AND SUNITA INDERJIT SINGH ..	321
Fellowships to French Graduates ..	316	Professor P. M. S. Blackett, F.R.S., Wins the Nobel Prize for Physics ..	323
On Estimating the Average Depth of Rainfall Over an Area and the Distribution of Raingauges. K. S. RAMAMURTI ..	317	Forthcoming International Congresses ..	323
Endowments of Nuffield Foundation ..	319	Letters to the Editor ..	324
		Reviews ..	335
		Science Notes and News ..	341

## WORLD'S PROSPECT OF FOOD AND AGRICULTURE

IN the course of an illuminating survey of the world conditions and prospects of the state of food and agriculture, the Food and Agriculture Organisation has highlighted the main achievements of the combined efforts of the United Nations in bringing relief to a hungry world. The survey shows that "millions of people are still hungry; world population is increasing more rapidly than production; soil erosion impoverishes many lands; forest resources are being depleted; the introduction of modern farming methods encounters serious difficulties; low income countries lack money for investment projects; international trade is seriously out of balance; and in the technically advanced countries there is growing concern as to whether

markets can be found for the surplus food which they are able to produce."

The overall production of foods and fibres in the world still remains inadequate and the Nations particularly of India and the Far East are not doing and striving enough to cope up with the world's long-term requirements. It is generally felt that this depressing circumstance is counter-balanced by the hopeful fact that we have in our possession enough technical knowledge which could be mobilised and harnessed in bringing about a substantial, even dramatic, increase in food production. As the F.A.O. Director-General Dodd adds in his Foreword to the Survey, "the difficulties which stand in the way of a really rapid expansion of production should be examined



more energetically by Governments, and decisions should be taken which will enlarge the programme and facilitate their speedier execution. There have been enough generalisations; what is now needed is practical action."

The survey describes in considerable detail the current situation in relation to consumption, price trends and international trade. The coming three years are considered to be crucial and it is expected that by 1950 the situation as regards production and consumption of food might reach a well balanced stage of sufficiency. This optimistic outlook is however subject to the condition that no unfavourable weather conditions would intervene during the period. So far as the Far and Near Eastern countries are concerned, the problem is more complicated. Low *per capita* incomes, lack of mechanical equipment, backwardness of industries, exhausted soils, lack of natural and artificial fertilisers, low efficiency of the bullock power due to inadequate and unbalanced feeding and the reduced efficiency of the human population due to malaria and malnutrition these constitute formidable obstacles to agricultural and to general economic development.

The 'grow more food' campaign sponsored by the Central, Provincial and other State Governments in India has not proved so successful as one would desire. The country continues to depend upon import of grains from foreign sources in ever-increasing quantities. Although the acreage under cultivation according to official sources, has increased, there has been no corresponding increase in the yield of crops. This is due to the poverty of our soils which need almost all the constituents of a good fertiliser. If fertilisers can be secured in adequate quantities, there is little need to extend our acreage. With better and more intensive methods of cultivation, and adequate manuring, the existing acreage can be made to contribute towards a considerable shortening of our food deficit. The extension of acreage under the auspices of the 'grow more food' campaign has been mostly accomplished at the expense of pasture lands and forests, which

would appear to be undesirable from the point of view of the welfare of our cattle, forest resources and rainfall. There should be a close interrelationship between agricultural policy and forest policy.

One of the potential sources of food which has not been adequately exploited is represented by the world's fisheries. The great bulk of the world's fish supply is at present caught in relatively small areas of the North Atlantic and North Pacific. The waters around Africa, Latin America, and South Asia have yet to be investigated to ascertain their yield capacity. Nor should the development of new freshwater fisheries be overlooked, especially in connection with irrigation projects.

The F.A.O. survey invites pointed attention to the conditions of ill-health and low vitality which impede the progress of agricultural production. Before the war it was estimated that nearly one-third of the world's population (about 650 million people) suffered from malaria. In the decade from 1932-41, 37 per cent. of the people of India died from that disease or its consequences. Intestinal diseases and parasites take an additional toll; for instance, half of Egypt's population suffers from bilharzia. Ill-health means reduced efficiency while people are working, and it also shortens their working life. The Indian born in 1931 had a life expectation of 26.5 years; the Englishman born in the same year, a life expectation of 61 years. This meant that pre-war India spent 22.5 per cent. of its national income on raising children who would make hardly any contribution to production, while England spent only 6.5 per cent. of its national income on the raising of children.

Efforts to improve education, health and other social services need to be considered as an indispensable counterpart of agricultural development. It is just as essential to have a school and school teacher to awaken the mind as it is to have fertilizer to stimulate the soil. It is just as essential to have a doctor as it is to have a veterinarian or a supply of pesticides. Indeed, a major attack upon rural conditions is a vital element in the battle of food production.

## CYTOGENETICS OF *NICOTIANA TABACUM* VAR. *VIRII* RESISTANT TO THE COMMON TOBACCO MOSAIC VIRUS\*

DONTCHO KOSTOFF

(Central Agricultural Research Institute, Sofia, Bulgaria.)

THE cytogenetics of plant forms obtained from interspecific and intergeneric crosses is of great significance in evolutionary and plant-breeding problems. Unfortunately very few of such crosses have been studied thoroughly. I have made such studies in the crop plant genera *Triticum*, *Secale*, *Nicotiana*, etc., and wish to deal here with the inheritance of a physiological character for virus resistance in *Nicotiana*.

The work was started with the aim of producing form of *Nicotiana tabacum* resistant to the common tobacco mosaic virus. This was to be secured by interspecific hybridisation of *N. tabacum* with a species which resists the virus, by producing localised necrotic reaction, and deriving from the hybrid a resistant tobacco plant with  $2N = 48$  chromosomes. The expectation was that gene or genes causing resistance could be transferred to chromosomes of *N. tabacum*. This was accomplished in two ways. Firstly by crossing two hybrids, (a) *N. rustica* RL  $\times$  *N. tabacum* Basma and (b) amphidiploid *N. glutinosa-tabacum*, and the  $F_1$  of this cross, was back-crossed to *N. tabacum* twice and selections selfed for homozygosity. Secondly, *N. tabacum* was repeatedly back-crossed to the amphidiploid, *N. glutinosa-tabacum*, and again selections selfed for homozygosity. Virus-resistant tobacco plants thus produced were called var. *virii*<sup>2</sup>.

*N. glutinosa* and a particular variety of *N. rustica* used in the crosses, show resistance to virus by localisation of virus around the source of infection. In all *N. tabacum* varieties, and in other varieties of *N. rustica* the virus spreads and kills the plants.

In this and other wide crosses, detailed cytogenetical analysis is essential to learn the evolutionary and plant-bleeding value of the crosses.

In the present instance the cytogenetic problem can be stated in the following terms. The dominant gene which restricts the spread of the virus (here termed Vr) has been transferred from another species to *N. tabacum*. Has the transfer been accomplished by transfer of a segment of a chromosome or by addition or substitution of an entire chromosome? The latter alternative means that in the resistant plant there are 23 pairs of *N. tabacum* chromosomes and one pair of foreign chromosomes (*glutinosa* or *rustica*) or even possibly 24 pairs of *N. tabacum* and one pair of foreign chromosome (designated Nch) making a total  $2N \approx 50$ . This last possibility, that is production of a stable form, with an additional chromosome pair of another species, was first suggested by the Russian worker M. Ternovsky<sup>3</sup> in 1935 and again by Gerstel<sup>4</sup> in 1946.

The present investigation supports the explanation given first. Our conclusion is, that resistant plants are usually produced by the cross-

over of a segment of chromosome Nch, containing gene for resistance to *N. tabacum* chromosomes. Gerstel studying Holmes' material and his own material assumes the other possibility, namely entire Nch chromosomes has been substituted or added. He had at hand my statement upon this problem, but did not consider it.

The cytological observations supporting the explanation offered is therefore important. Primary evidence is this. My observation is that in an interspecific cross, two to six chromosomes of *N. glutinosa* conjugate frequently with those of *N. tabacum*, contradictory to the observations of some other investigators. It is evident that conditions under which the  $F_1$  develops influences the degree of chromosome conjugation. Occurrence of conjugation is responsible to a great extent for the inconstancy in the amphidiploid *glutinosa-tabacum*, which was shown by Muntzing.<sup>5</sup> Gerstel holds the view that "the transfer of genes from one species to another is impossible, because of failure of chromosomes to conjugate and to cross over in the hybrid," and also that there is lack of homology between the chromosomes concerned. However, Gerstel's view that a substitution of homologous chromosomes can occur, contradicts his own arguments, and supports the present observation.

The meiotic stages in hybrids between the virus resistant tobacco, *N. tabacum virii*, with closely related susceptible varieties of tobacco have been studied by me, and supports my interpretation. Two examples are given here. In the  $F_1$  hybrids of *N. tabacum virii* 'alba' and *N. t. 'Nevrocop Basma'* the complete regular pairing was observed in 108 P.M.C. and only in 7 P.M.C. did 23 pairs and two univalents appear. In the  $F_1$  of another cross *N. t. virii* 'alba' with *N. t. Serska Basma* regular pairing was seen in 84 P.M.C. and univalents only in 4 P.M.C. These data show that in the majority of the cases, the chromosome carrying the dominant gene Vr for virus resistance, conjugates readily with its pure *N. tabacum* partner. Only in a few cases (7.4% and 4.8%) the conjugation fails, which can be accounted for by the non homologous segment carrying Vr gene. These data can be interpreted by assuming that the chromosome segment controlling virus resistance has been transferred from one species to another, by cross-over in the interspecific cross. In other words we have a transfer of an important physiological character from one species to the background of another, preserving the chromosome number and homology of the economic species. This factor facilitates further breeding work, i.e., the transfer of the resistance gene to any other economic variety. Cytogenetic work appears here as distinctly separated from plant-breeding work. On the one hand study of cytogenetics

This Article by Dr. Kostoff which is likely to be of interest to all plant breeders, has been altered from its original form, the editing having been done to make it conform to accepted standard of English diction and idiom.—(Editor's note)



of species and their hybrids gives a background for accomplishing the transfer of a desirable gene or gene-complex from one species to another, preserving the genom of the latter plant. At this stage cytogenetic work ends and the plant-breeding work begins, using the derived form for transferring the new characteristic to such economic varieties, as desired, for different localities and purposes.

A synthetic species alike to *N. tabacum* was produced by me<sup>6,7</sup> in 1936, using two genoms of *N. silvestris*, and two genoms of *N. tomentosiformis* and similar work has been done by Greenleaf<sup>9</sup> in 1941. Stebbins<sup>8</sup> gives the data, but gives priority to Greenleaf, however. This data, and observations in other *Nicotiana* species hybrids, done by me, show the chromosome homologies in the different species. In *glutinosa* × *silvestris* 1-5 bivalents, in *glutinosa* × *tomentosiformis* 5-8 bivalents and in *glutinosa* × *tabacum* 2-6 bivalents are formed frequently. This behaviour suggests possibilities in breeding by transfer of a segment or entire chromosome from one species to another.

Even Gerstel's data are in favour of this conception, as he suggests possibility of a exchange transfer of an entire chromosome.

From plant-breeding point of view, substitutions of an entire chromosome pair from a wild into a cultivated species is not desirable, as the entire chromosome can contribute undesirable characters. In the present work, *N. tabacum* var *virii* enabled me to produce by hybridisation and selection, virus-resistant plants having good yield and excellent quality. It is doubtful if such quality can be obtained if an entire chromosome pair had been substituted.

From evolutionary and plant breeding point of view, chromosome substitution has restricted possibilities in production of new forms, as compared to possibilities by a transfer of a gene or small group of genes. The genomic background of a species is less affected by the transfer of a small portion of a chromosome. In addition, fertility of the new hybrid is not much affected. In plant breeding, such forms can be used to transfer the new character to other varieties. I shall not be surprised if in a short time all cultivated tobacco varieties are corrected in this respect, i.e., all of them made resistant to the common tobacco mosaic virus with the use of *N. t. virii*.

This paper is to show once more that cytogenetics both stimulates the development of other biological sciences and gives a real background for the development of applied sciences—in this case contributing to the production of newer and better crop plant.

Thanks are due to R. Georgieva and D. Tzikov for help throughout this work.

1. Kostoff, D., *Phytopath. Zeitschr.*, 1937, **10**, 578-93.
2. Kostoff, D., "Resistant tobacco varieties against mosaic virus experimentally produced, Sofia", 1944.
3. Ternovsky, M., *Zeitschr. f. Zuchtung, Reihe A. Pflanzenzuchtung*, 1935, **20**, 268-89.
4. Gerstel, D. U., *Genetics*, 1946, **31**, 42-427.
5. Muntzing, A., *Hereditas*, 1935, **20**, 251-72.
6. Kostoff, D., *Curr. Sci.*, 1936, **4**, 872.
7. Kostoff, D., *Compt. Rend. (Doklady) Acad. Sci., USSR*, 1938, **18**, 7.
8. Stebbins, G. L., *Advance in Genetics*, 1947, **1**, 403-29.
9. Greenleaf, W. H., *Genetics*, 1941, **26**, 301-24.
10. Kostoff, D., *Cytogenetics of the Genus Nicotiana, Sofia*, 1941-43, **1-28**, 1-1071.

## FELLOWSHIPS TO FRENCH GRADUATES

WITH a view to strengthening the cultural-bonds between India and France, the Ministry of Education, Government of India, propose to award nine Fellowships to suitable French graduates for research work and teaching in Indian Universities in 1949. This is in response to the interest shown by the French Government in cultivating the study of the Indian languages and literature amongst the French people.

Last year the French Government awarded nine scholarships to Indian students. They have awarded another ten scholarships in the current year. They have also sent out three French students to India to study Hindi and another student is coming shortly to study Sanskrit literature.

The value of the Fellowships to be granted by the Government of India has been fixed at Rs. 500 per month for a period of two years plus the cost of second-class return passage. Each Fellow would be expected to undertake teaching in the French language and literature at an Indian University in addition to his own work. The actual number of Fellowships granted will depend on the response from the Universities.

In a letter addressed to the Vice-Chancellors of Universities in India, the Ministry of Education have proposed that the cost of each Fellowship may be shared equally between the Government of India and the University at which the Fellow will be placed. By this means, the University will secure an efficient tutor of French language and literature at a cost of about Rs. 250 per month and half the share of the passage.

There has been a rapid development of our foreign contacts and there is a growing demand in Indian Universities for instruction in foreign languages. It may even be possible to secure as Fellows French students competent to give instruction in French as well as other European languages.

From the cultural view-point also, it is felt that India should adopt a wider outlook and should take all possible steps to encourage the promotion of reciprocal cultural exchanges with foreign countries.

The Government of India have asked each University to let them know if it would be willing to accept one or two Fellows and would be prepared to meet half the expenses as proposed by the Government.

# ON ESTIMATING THE AVERAGE DEPTH OF RAINFALL OVER AN AREA AND THE DISTRIBUTION OF RAINGAUGES

K. S. RAMAMURTI

(Poona)

## INTRODUCTION

THE average depth of rainfall over an area is usually calculated as the arithmetic mean of the rainfall amounts recorded at all the raingauge stations in it. The India Meteorological Department is adopting this method in arriving at the mean rainfall figures for the various subdivisions of India.

Satakopan and Vittal Sarma<sup>1</sup> have made a study of the optimum number of rain-recording stations required in catchments for estimating run-off. They have also calculated the average rainfall as the arithmetic mean of the rainfall amounts recorded at various stations in the catchment, though they refer to the unsatisfactory distribution of the raingauges over the area. In addition they have assumed that the variability (s.e. is considered) of the average to be  $\sigma/\sqrt{n}$ , where  $\sigma$  is the standard deviation and  $n$  the number of observations. It has been pointed out that this assumption holds good for distributions which are not highly skew.

The average depth estimated as indicated above will be subject to an error even when the raingauges are evenly distributed; but will give an altogether erroneous idea of the rain amount if the raingauge stations are badly distributed, e.g., majority of the gauges are located in the region with more rainfall while a few only are in the region with less rainfall or vice versa.

In this note the distribution of the rain-recording stations necessary for calculating the average rainfall over an area as the arithmetic mean of the observed values is discussed. The maximum error in the estimate is also studied under some simplifying assumptions regarding the rain-field. A general suggestion regarding the distribution of rain-recording stations over the country is made.

## DISCUSSION

The variation of rainfall in space is a complex phenomenon. In the following discussion continuity of rainfall in space has been assumed. It may be mentioned that spatial continuity could be assumed in cases when rainfall is widespread, or when considering the monthly, seasonal, etc., total amounts. Drawing of isohyets is based on this assumption.

The total rain amount over an area is  $\int_D R dA$

where  $R$  is the rainfall at any location in the region  $D$  and  $dA$  is an element of area around the location. The integration is taken over the whole region  $D$ . The mean depth of rain water is  $\int_D R dA / \int_D dA$ .

Let  $C$  be the boundary of  $D$ . Let the number of raingauges in the area be sufficient to draw isohyets at an interval of  $\tau$  and let these isohyets divide  $D$  into sub-regions  $D_1, D_2, \dots, D_n$  with areas  $a_1, a_2, \dots, a_n$ . Here  $D_p$  includes

all the sub-regions in  $D$  lying between the same isohyets.

$$\text{Then } \int_D R dA = \sum_{m=1}^n \int_{D_m} R dA$$

Let  $R_m = \frac{1}{2} (R_{\max} + R_{\min})$ , where  $R_{\max}, R_{\min} \in D_m$ . That is,  $R_m$  is the average of the rainfalls at the two bounding isohyets.

The total rain amount may now be estimated as

$$\sum_{m=1}^n R_m a_m \text{ and the error in this estimate is}$$

$$\sum_{m=1}^n \int_{D_m} (R - R_m) dA \dots \dots R_m a_m = \int_{D_m} R_m dA$$

$$|R - R_m| \leq \tau/2, \dots, R, R_m \in D_m$$

$$\therefore \text{the error} \leq \tau/2 \sum_{m=1}^n \int_{D_m} dA$$

$$\leq \tau/2 \cdot A, \text{ where } A \text{ is the total area.}$$

Hence the utmost error in the estimate of the average depth of rainfall over the area is  $\tau/2$  inches.....(I)

The above method is rather too laborious to be practical use except when high accuracy is required. It assumes the existence of a sufficient number of raingauge stations distributed over the region to enable the drawing of isohyets at required intervals. Any mal-distribution like too many raingauges in one part of the area and comparative scarcity in another will not effect the accuracy. Hence no particular design in the distribution of the stations is necessary except that required for fixing the isohyets.

Let us now allot to each  $D_m$  a certain number  $n_m$  of rain-recording stations such that  $n_m$  is proportional to  $a_m$ . The estimated rain amount be

$$\sum_{m=1}^n R'_m n_m, \text{ where } R'_m = \frac{1}{n_m} \sum_{p=1}^{n_m} R_p$$

Thus an estimate of the average rainfall of the region based on  $N$  ( $\sum n_m$ ) observations is the average of the rain amounts recorded at all the stations in the area, viz.,

$$\frac{1}{N} \sum R,$$

where  $R$  is the rainfall recorded at any of the stations.

By proper choice of the unit of area, it is possible to set  $a_m = n_m$ .

Since now,  $|R - R'_m| \leq \tau, \dots, R, R'_m \in D_m$

$$\text{The error} = \sum_{m=1}^n \int_{D_m} (R - R'_m) dA < \tau A.$$

$\therefore$  the error in the average  $\leq \tau$ .....(II). That is, if the raingauges are distributed such that each  $D_m$  has an  $n_m$  of them,  $n_m$  being proportional to  $a_m$ , then the average rainfall

derived from these  $N$  stations will represent the mean rainfall over the region, with a maximum error given by  $\tau$ . On a fairly even terrain, where the distribution of rainfall is more smooth and has less variability, an even distribution of the raingauges, say, at equal distances along latitudes and longitudes will in general ensure that the number of raingauges in  $D_m$  is proportional to  $a_m$  for sufficiently large  $\tau$ . Therefore an even distribution of the stations over a fairly even region is a prerequisite for estimating the average rainfall as the arithmetic mean of the rainfall recorded at a number of locations in the area. A non-uniform distribution will give a higher weightage to the rainfall recorded in the regions with denser distribution of raingauges and less weightage to that in regions with sparser distribution.

The distribution of raingauges in any part of India is at present far from even. Hence the arithmetic mean of the falls recorded at these stations may not give a correct estimate of the rainfall over the area on most occasions. The Central Board of Irrigation in India has recently recommended a distribution of one gauge per square of 25 miles, i.e., per 625 sq. miles.<sup>2</sup> These when distributed one for every 25 miles square may prove to be sufficient for all climatological purposes.

The normal gradient of isohyets becomes steep in the hilly regions due to the influence of orography on rainfall. That is, the number of isohyets at interval  $\tau$  that cut across a unit area increases over this region. Therefore to fix up the isohyets at the same interval we require a denser distribution of rain-recording stations over these regions. But, while working out the average rainfall over any area of which these regions with denser distribution form a part, allowance has to be made for the density. For example, if the distribution over a part of the area is  $k$  times as dense as the general distribution over the plain country, the total amount as well as the number of the stations have to be weighted by  $1/k$  before combining these with the totals of the rest of the rainfall observations.

Having distributed the raingauges as stated above let us estimate the error in the average rainfall over an even region in terms of  $\rho$ , the range of rainfall, and  $N$  the number of raingauges in the region. For this purpose, the rainfall is assumed uni-modal with concentric circular isohyets.\* Let  $N$  ( $n \times n$ ) unit square cells with one raingauge in each cover the field completely. Let  $\rho$  be the total range of rainfall in the field. The range will vary from cell to cell. The mean range is easily seen to be  $2\rho/n$ . If  $R_{p,q}$  is the rainfall amount measured at the station in the  $p$ th row and  $q$ th column

and  $\tau_{p,q}$  the range in the cell enclosing the station, the error in the estimate of the total quantity in the cell  $(p, q)$  is

$$\begin{aligned} \int_{(p,q)} R dA - R_{p,q} \times 1 \\ = \int_{(p,q)} (R - R_{p,q}) dA \\ \therefore \text{cell } (p, q) \text{ has unit area.} \\ < \tau_{p,q} \int_{(p,q)} dA \\ < \tau_{p,q} \times 1 \end{aligned}$$

Hence the error in the estimate of total amount over the whole field

$$\begin{aligned} < \sum_{p=1}^n \sum_{q=1}^n \tau_{p,q} \times 1 \\ < \frac{2\rho}{n} n^2. \end{aligned}$$

Therefore the error in the mean is

$$\begin{aligned} < \frac{2\rho}{n} \\ \therefore n^2 = N \text{ is the total area,} \\ < \frac{2\rho}{\sqrt{N}} \end{aligned}$$

The conditions set forth have all been used for arriving at the final error. Hence these conditions are essential for assuming the error to be  $2\rho/\sqrt{N}$ .

#### CONCLUDING REMARKS

But the spatial variation of rainfall is much more complex and particularly so in river catchments where orography makes the distribution even non-uni-modal. A purely theoretical analysis of such cases is therefore more involved. In general, the depth of rainfall varies inversely with the area.<sup>3</sup> The author understands from Mr. V. Satakopan that he is studying the distribution of rainfall in space and that he also finds that both spatial and temporal distributions approximate to L-shaped curves. That is, the sub-regions  $D_m$  are such that  $a_m$  is a monotonic sequence. The error in the estimate of average rainfall is being studied under this distribution law.

The author is thankful to Mr. V. Satakopan for helpful criticism.

1. V. Satakopan and V. Vittal Sarma, 1947, "Determination of the Optimum Number of Rain-recording Stations Required in Catchments for Estimating Run-off"—Paper submitted to the Research Committee meeting of the Central Board of Irrigation, held in July 1947.
2. V. V. Sohoni, Hydro-meteorology in India, *Jour. Sci. and Indus. Res.*, 1948, 7, 5, p 222-227.
3. Hydrology, 1942, Physics of the Earth IX, McGraw-Hill Book Company, New York and London.

*Note*—The cost of printing this contribution has been defrayed by a generous grant from the Rockefeller Foundation for the publication of results of scientific work made to us through the kindness of the National Institute of Sciences, India—Ed.

\* This type of field will be approximately realised when considering the rainfall on a day when a storm is centred in the region.

## ENDOWMENTS OF NUFFIELD FOUNDATION

TEN models of a new type of reflecting microscope, designed by Dr. C. R. Burch of Bristol University, have been built with the aid of a grant made by the Nuffield Foundation. This interesting fact was recently published in the *British Medical Journal*. The new appliance will, in the main, be used for research on carcinogenetic substances. It differs from the old type of refraction microscope and refracting ultra-violet ray microscope, in that it has two aspheric surfaces instead of one.

Many millions of pounds have already been given by Lord Nuffield for philanthropic and scientific purposes, including a £ 2,000,000 (Rs. 2.66 crores) grant to Oxford University. In all, Lord Nuffield has made gifts totalling about £ 16,000,000 (Rs. 21.30 crores). The most important of these is perhaps the foundation which bears his name, the Nuffield foundation, which was established at the beginning of 1943 and endowed with Ordinary Stock Units of Morris Motors Ltd., of which Lord Nuffield is the founder, to the value of £ 10,000,000 (Rs. 13.31 crores).

### THREE MAIN OBJECTS

The three main objects of the Foundation are :

- (a) The advancement of health and the prevention and relief of sickness...in particular...by medical research and teaching and by the organisation and development of medical and health services.
- (b) The advancement of social well-being, in particular, by scientific research and the organisation, development and improvement of technical and commercial education including the training of teachers and provision of scholarships and prizes.
- (c) The care and comfort of the aged poor.

It might be assumed that such foundations would be superfluous in Britain with her national health service and highly developed system of education, but as all these things have to be paid for out of the taxpayer's pocket, the money required for research purposes has to be handled very carefully. At times scientific research work meets with failure or gives results which have no immediate practical value. The financial risks involved in such work cannot be borne by the State and it is here that the Nuffield Foundation steps in by assisting prudent pioneer work, and at the same time working hand in hand with the Government departments concerned.

### STUDY OF RHEUMATISM

During the first four years of its existence, the Foundation made grants totalling £ 1,182,820 (Rs. 1.57 crores). One of the main branches of medical research to benefit from the Nuffield Foundation was the study of chronic rheumatism. Statistics published by the Ministry of Health for the year 1922 showed that rheumatism was responsible for one-sixth of the cases of sickness arising among insured workers, that £ 2,000,000 (Rs. 2.63 crores) had to be paid out in sickness benefit and that there was a loss of 3,000,000 weeks of working time.

The new national health insurance, which covers the whole of Britain, estimates that one-third of the payments made will be in respect of chronic rheumatism. When the Ministry of Health recommended the setting up of the first Rheumatism Centre in 1945, the Foundation made a grant of £ 101,000 (Rs. 13.31 lakhs) to the University of Manchester for the establishment of a diagnostic and research centre at the Manchester Royal Infirmary.

A similar sum was given to the Institute of Child Health set up in 1944 by the University of London. Durham and Glasgow Universities each received £ 40,000 (Rs. 5.32 lakhs). Manchester University received £ 70,000 (Rs. 9.31 lakhs) for industrial health research. Durham specialised mainly in research on the health of coal-mining and ship-building workers. Finally, £ 150,000 (Rs. 19.96 lakhs) was paid out to encourage suitable persons to undertake an academic career in dentistry.

Natural Sciences, too, have not been forgotten; Birmingham and Glasgow Universities have received grants for research purposes in nuclear physics and radiation, while Birkbeck College, London, has set up a research laboratory on bio-molecular studies under Professor J. D. Bernal, F.R.S.

### TRAVELLING FELLOWSHIPS

In all £ 35,000 (Rs. 4.65 lakhs) has been granted by the Foundation to the Institution of Mining and Metallurgy, to be devoted to a scheme of travelling fellowships and scholarships for teachers and, £ 40,000 (Rs. 5.32 lakhs) to a scheme of research. Similar amounts have been given to university laboratories and other scientific institutions for improvement of their equipment.

We cannot go into detail here regarding all the various branches of research encouraged by the Nuffield Foundation. It suffices to say that studies in the sphere of social science, political and economic planning, population problems, statistics and the law will all be encouraged, to say nothing of the generous grants devoted to the improvement of education and the accommodation and care of old people.



## NEW LAMPS FOR OLD\*

THE incandescent filament lamp which has held the field of electrical illumination for more than half a century seems to be confronted now by the discharge lamp, a rival gradually appearing above the horizon. The mercury and the sodium discharge lamps on account of their low power consumption and efficient lighting, have come to be installed on highways and public places as well as in shop windows. These together with the well established 'neon' advertisement signs which are also 'lamps' of the discharge type, add considerably to the conveniences and attraction of a modern city.

An interesting development of the mercury vapour discharge lamp which is very recent in origin is to be seen in the nightly demonstration almost in all the towns nowadays of what was once but a laboratory curiosity. The fluorescent property of a class of solid materials has been harnessed by the utilization of the large amount of ultra-violet light available in the low pressure type of mercury discharge lamp. This excites fluorescence of 'day-light' or other suitable colour throughout the long track of light in the lamp-tube lined with fluorescent powders. The popular demand for this type of lamp indoors in home, shop and in industrial occupations is growing.

In its scientific and technical applications however, the progress made by the mercury lamp has been slower. As a convenient source of monochromatic radiations in the visible as well as in the ultra-violet regions of the spectrum in a large number of scientific investigations it has stood for more than thirty years as the best in the field and is in no danger of being displaced. Indeed, with the development of many new types, it may find increasing favour by the scientific workers. The Raman Effect owes its discovery to this lamp. Yet, for other purposes, as an illuminant in photographic and projection work it has still to make a headway. Mr. Bourne's book under notice, as its title shows, deals with these applications of the discharge lamps, in particular with the mercury vapour class and a perusal of the last chapter will convince any sceptic that the mercury arc has a great many advantages over the incandescent filament and the carbon arc now in common use.

The author after describing the characteristics of the incandescent filament and the carbon arc lamps as light sources for photographic and projection purposes in the first four chapters of the book, devotes the rest of the nine chapters covering eighty per cent. of the printed matter, to discharge lamps, various types of mercury arcs naturally receiving most of the attention. The discharge characteristics in mercury vapour under every possible conditions of excitation has been treated in great details. Considerations which enter into the design and construction of lamps of various size and shape to suit either the operational

conditions or some specific need have been fully brought out. Thus the effect of variation in pressures and arc loading per unit length on the spectral distribution, luminous efficiency and the voltage-wattage characteristics of the lamps of various types is clearly discussed and the necessary information is given about the composition of the glass or quartz employed for enclosing the arc, the seals, the electrode materials and the general dimensions of the completed lamp, in each case. A large number of tables, graphs and photographs scattered throughout the book greatly enhance its value. Ten appendices at the end supply a glossary and definitions of terms used in photography, illumination and photometry, nomenclature for various types of mercury vapour lamps, symbols and expressions used in their design, brightness data for various celestial and terrestrial sources of light, information about the range of the electromagnetic spectrum, the speed of various photographic emulsions, characteristics of exposure meters, etc.

A brief review may be now made of the various types of mercury vapour discharge lamps described in the book.

**MA:** This type is a glass enclosed linear source working at a pressure of one atmosphere. With a loading of 20-30 watts and a potential gradient of 5-10 volts per cm. its luminous efficiency is 40/60 lumens per watt while the brightness of the source is 150 candles per unit area of the surface during a life of 1500 hours. The lamp finds extensive application in street and industrial lighting.

**MB:** The MB type which works at much higher pressures of 5-10 atmospheres in a quartz tube has the same luminous efficiency and life as the MA type, but on account of the higher pressure employed, higher arc loading is possible, resulting in a brightness per unit area which is 6 to 7 times greater than the MA type.

**ME and MD:** These two types work at a still higher pressure in quartz—the former at 20-40 and the latter at 75-100 atmospheres needing a forced cooling by air or water. The ME type lamps which are made in compact form in a spherical enclosure, are very convenient concentrated sources, giving a high brightness, namely 10,000 candles per square cm. They have a fairly good life of 500 hours. Both these lamps have about the same arc loading of 400 to 1000 watts per cm. but the ME type being more compact it has a greater brightness per unit area of the surface. The luminous efficiency of the water cooled MD arc is however 60-65 lumens per watt, being 50 per cent. above any other type. However owing to the rapid devitrification of quartz on account of the high dissipation of power, the water cooled lamp has a life of 25-100 hours only and it needs a special high voltage and water supply.

In an experimental MD type lamp running at 1400 watts loading and 805 volts per cm. and taking a current of 2.1 amperes, a brightness of 180,000 candles, equal to that of the sun and probably the highest for a terrestrial

\*Discharge Lamps for Photography and Projection.  
By H. K. Bourne. (Chapman & Hall, London), 1948.  
Pp. 421 + xv. 36s.

source, has been recorded. The lamp worked at 200 atmospheres and its temperature was estimated at 89,000° K. For the reason given above however, the life of such a lamp is only a matter of few minutes. The spectrum of this source shows considerably broadened lines with a continuous background.

The compact source M E type of lamp's high brightness, long life and useful optical characteristics makes it suitable for a variety of purposes. It is thus an admirable substitute for the carbon arc and being sealed in an enclosure is much cleaner to work with. These lamps are made in wattages varying from 100 watts to 25 kilowatts.

For use in the 16 mm. and other substandard film projectors as well as in lantern slides and episcopes projectors, the M E type mercury arcs give satisfactory performance. With the same power consumption as an incandescent filament lamp and at the same time reducing by half the amount of heating associated with it, a 250 or 500 watts lamp in a projector increases the screen illumination from 100-250 lumens to 250-1000 lumens per watt. For a high power 35 mm. standard cine projector the high pressure mercury lamp could be used, but compared with a modern high intensity carbon arc the chief drawback is its very short life of 25 hours. Colour rendering is also rather poor with these lamps.

M C F: This is the now common type of fluorescent lamp, the 40 and 80 watts units having a glass tube-length of 4 and 5 feet respectively. The lamp differs from all the rest in that it works at a very low mercury vapour pressure of 0.015 mm. Its unusual length as an ordinary illuminant is a consequence of the very low potential gradient of 1 volt per cm. necessary to maintain the tube at a low temperature not exceeding 60° C., for it is at about this optimum temperature that the intensity of the fluorescent light from the powders is at a maximum. The lamp through the agency of the ultra-violet light at the wavelength 2537 Å raises its original luminous efficiency from 5 to 35 lumens per watt, which is nearly three times greater than an incandescent filament light. This combined with a life which is also three times greater, (3,000 hours) more than compensates the high initial cost of the lamp. For home lighting either in the cool 'day-light' form or in the

'warm white' form, it would be therefore cheaper to have this type of lights which are now available in wattages varying from 6 to 80. Thus a 15 watt fluorescent lamp may be substituted for an ordinary 40 watt incandescent filament lamp, the total number of lumens obtained in each case being  $15 \times 35 = 525$  and  $12 \times 40 = 480$ , respectively.

As sources of high actinic value, the M A, M B as well as the M C F mercury lamps have proved useful and economical in all types of photographic and photomechanical work such as copying, printing and enlarging and for photographic, movie and television studios.

For photography under poor illumination and for high speed photography in the study of motion, light-flashes of high intensity and durations ranging from a few milliseconds to a few microseconds, according to the motion of the object and speed of the camera shutter, are necessary. The old magnesium burning technique was replaced in 1930 by the American photoflash bulbs containing thin aluminium foil and oxygen. Such lamps which run on dry cells are useful only once, but they are still used. They give a total light output of the order of a million lumens while the least duration of the flash is 5 milliseconds above the half peak value.

The advantages of an electric discharge flash-lamp over the last one are that it could be repeatedly used while the intensity of light as well as the duration of the flash and the interval between successive flashes could be all conveniently controlled by suitably changing the current conditions of one of the high pressure type of mercury lamp. Synchronisation with the shutter speed is also easily obtained. A further advance in flash photography has been however made by the stroboscopic discharge lamps which give flashes of 10-100 microseconds duration through a condenser discharge in mercury vapour or in one of the rare gases.

With a wealth of information given only in its bare outline here, it would be hardly necessary to add that this treatise on discharge lamps would be eagerly sought for by the technical reader who wants to know any thing about the mercury vapour lamp—a lamp more wonderful than the Alladin's.

B. K. VAIDYA.

## TONUS IN UNSTRIATED MUSCLE

INDERJIT SINGH AND SUNITA INDERJIT SINGH

(From the Physiological Laboratory, Medical College, Agra)

TONUS in unstriated muscle has been variously explained. It has been ascribed to a catch mechanism<sup>1,2</sup> or to increase in viscosity.<sup>3,4,5,6</sup>

There are two kinds of tone<sup>7</sup>. During one the oxygen consumption increases<sup>8</sup> and during the other it decreases.<sup>8,9</sup> Similarly there are two kinds of inhibition, during one the oxygen consumption increases and during the other it decreases.<sup>8</sup> Correspondingly it has been found that as a result of asphyxia or treat-

ment with cyanide, tone may increase or decrease.<sup>10,11,12,13</sup>

The asphyxial contraction is decreased by oxygen as well as by glucose.<sup>10,14</sup> The action of glucose is antagonised by iodoacetic acid. Thus energy is required to keep the muscle elongated. The normal contractions of unstriated muscle are produced on a background of inhibition. This is also shown by the action of iodoacetic acid which abolishes this inhibition and causes the muscle to contract. The

contractions of unstriated muscle are then produced on a background of tonus. The asphyxial contraction may provisionally be termed 'alactic' tone in contrast to the other tone which is increased by oxygen and glucose—"lactic" tone. It cannot however definitely be said that the former tone only develops when lactic acid production fails or that the latter tone derives its energy only from the production of lactic acid.

When the asphyxial contraction has maximally developed, the muscle still responds to electric current, potassium and acetylcholine, through inhibition by adrenaline, cannot be produced. This shows that the asphyxial contraction is not due to depletion of the entire energy reserves of the muscle.

The inhibitory action of glucose on the asphyxial contraction is temporary. It causes a fundamental change in the properties of the muscle. In its absence, oxygen inhibits the asphyxial contraction, but in its presence it has the opposite action. Thus if glucose is added when the asphyxial tension is rising, after a short period of inhibition, the tension may continue to rise and oxygen now further increases the tension. If the muscle is now asphyxiated, the tension built by the alactic mechanism is lost by the lactic mechanism during asphyxiation. The taking-over by the lactic from the alactic mechanism may be immediate, in which case the inhibitory action of glucose is not apparent.

The chief properties of the asphyxial contraction are (1) that it does not diminish on exclusion of oxygen or addition of sodium cyanide (1 in 10,000). (2) It is converted into lactic tone by glucose. These two properties are shown by muscle removed freshly from an animal. Such a contraction is produced by stimulation with direct current, potassium, barium, iodoide, thiocyanate, acetylcholine, even in the presence of oxygen. The contraction produced by iodoacetic acid also does not diminish on the exclusion of oxygen. This suggests that the "asphyxial" contraction is a normal phenomenon and is the tone by means of which unstriated muscle is able to maintain tension without expenditure of energy.

One characteristic of unstriated muscle is slow relaxation. If the muscle is asphyxiated in the presence of a stimulant such as potassium, the withdrawal of potassium does not cause the muscle to relax, as it does in the presence of oxygen. The muscle now relaxes slowly. The properties of this slow relaxation are identical with those of asphyxial contraction or alactic tone. Such slow relaxation is produced even in the presence of oxygen and we have found cyanide and asphyxia to be the most powerful agents in causing such slow relaxation.

Different muscles are affected differently by asphyxia. In the fowl's gut muscle, the asphyxial contraction is hardly noticeable, but

the action of glucose shows that it has passed into the "asphyxial state", even though the muscle is relaxed. In frog's stomach muscle oxygen has inhibitory effect on the asphyxial contraction, but in the dog's stomach muscle the effect is less marked. In the frog's stomach muscle, the action of glucose is less marked than in dog's stomach muscle. The normal tone in unstriated muscle is a mixture of lactic and alactic tones. In some muscles, such as the fowl's gut muscle lactic tone predominates, in dog's stomach muscle the alactic tone predominates.

The above view of tonus in unstriated muscle is supported by the phenomenon of active elongation.<sup>15, 16, 17</sup> In dog's stomach muscle, active elongation of a twitch contraction occurs. In frog's stomach muscle active elongation of a normal tonic contraction occurs.

The above experiments show that tonus in unstriated muscle is due to contraction. The question arises, how can production of lactic acid cause relaxation and contraction at the same time? It appears that in the muscle there are two different proteins, which are acted upon differently by production of lactic acid, or in the same protein, there are chemical groupings so acted upon. If energy is required to keep the muscle relaxed, the increased oxygen consumption may be due to greater effort at relaxation during contraction. During twitch contraction such an effort might occur, but not during tonic contraction, thus accounting for the difference in oxygen consumption during the two kinds of contraction. It appears that the excitatory and inhibitory processes occur simultaneously, and this perhaps accounts for the existence of a dual nerve supply to unstriated muscle.

1. Grutzner, P., *Ergeb. Physiol.*, 1904, **3**, 12. Quoted from C. Lovatt Evans, *General Physiology*. London, 1940 p. 534.
2. Von Uexkull, J., *Zs. Biol.*, 1912, **58**, 305. Quoted from C. Lovatt Evans, *General Physiology*. London, 1940, 534.
3. Bayliss, L. E., *J. Physiol.*, 1928, **65**, 1P.
4. Winton, F. R., *J. Physiol.*, 1930, p. 69, 393.
5. Hozler, *Zeitsch. F. Vergleich. Physiol.*, 1931, **14**, 429. Quoted from W. H. Howell, *Text Book of Physiology*, London, 1940, 38.
6. Singh, I., *J. Physiol.*, 1938a, **91**, 398; 1938b, **92**, 62; 1938c, **92**, 232; 1938d, **94**, 1 *Ind. Journ. Med. Res.*, 1942, **30**, 449; *Proc. Ind. Acad. Sci.*, 1943a, **17**, 13; 1943b, **17**, 20; 1943c, **18**, 53; 1945a, **22**, 76; 1945b, **22**, 183; *Curr. Sci.*, 1941, **13**, 311. *Proc. Ind. Acad. Sci.*, 1946, **23**, 58.
7. —, *Ibid.*, 1946, **23**, 312.
8. Rao, M. S., and Singh, I., *J. Physiol.*, 1940, **98**, 12.
9. Lovatt Evans, C., 1923, **58**, 22.
10. Singh, I., and Singh, I., *Proc. Ind. Acad. Sci.*, 1948, **27**, 127.
11. —, *Curr. Sci.*, 1947, **16**, 259.
12. —, *J. Physiol.*, 1937, **89**, 8.
13. —, *Proc. Ind. Acad. Sci.*, 1946, **23**, 301.
14. —, *Ibid.*, In the Press.
15. —, *Curr. Sci.*, 1944, **13**, 311.
16. —, Singh, I. and Muthana, M. C., *Proc. Ind. Acad. Sci.*, 1947, **25**, 51.
17. —, *Curr. Sci.*, 1948, **17**, 306. In the Press.



## PROFESSOR P. M. S. BLACKETT, F.R.S., WINS THE NOBEL PRIZE FOR PHYSICS

THE Nobel Prize for Physics has been awarded to Professor P. M. S. Blackett, who was in India recently to advise the Ministry of Defence in the building up of a sound scientific organisation. In 1947, when he attended the Indian Science Congress, an Honorary Doctorate of the University of Delhi was conferred on this British scientist of world fame.

Professor Blackett, who is 51, came into prominence during the summer of last year when he announced a new fundamental law in Physics. Scientific publications all over the world hailed it as one of the major discoveries of the century and compared the new knowledge gained with such achievements as Newton's law of gravitation, the second law of thermodynamics, Faraday's discovery of the correlation of magnetism and electricity, Maxwell's electromagnetic theory of light, and certain aspects of Einstein's theory of relativity.

Professor Blackett's new law furnished an explanation of terrestrial magnetism, establishing a connection for the first time between two fields of Physics—mechanics and electromagnetism.

Throughout World War II, Prof. Blackett was engaged on highly secret research work for the British Government. He had already gained a world-wide reputation for his work on atomic physics, especially on positive electrons and cosmic rays. Early in the war he was attached to the Admiralty, thus renewing his old association with the Navy, for Blackett began life as a sailor.

In 1933, Blackett was elected F.R.S., and became Professor of Physics at Birkbeck College, University of London. He remained there until 1937; at the same time he continued his research, spending part of his time in a laboratory set up on a disused platform of the Underground Station at Holborn. In 1934 he addressed the International Conference of Physics, held at the Royal Institution, describing the results of his research on cosmic rays. His work was recognised in 1940 by the award of the Royal Medal of the Royal Society.

He has been Professor of Physics at Manchester University since 1937 and has received some of the highest honours both in his own country and in the United States.

### FORTHCOMING INTERNATIONAL CONGRESSES

Date	Year	Sponsored by	Place	Title
May ..	1949			Pan-American Research Conference.
May 16- ..	"	ECOSOC	U.S.A.	U. N. Conference on Conservation and Utilisation of Natural Resources.
June 3 ..	"			
June 14-16 ..	"	ICSU	Paris	Committee on Science and its Social Relations.
June 20-25 ..	"	UNESCO	"	International Conference on "Science Abstracting".
Aug. 15-19 ..	"		Stockholm (Sweden)	XIIth International Dairy Congress.
Sept. 6-10 ..	"	IUC	Amsterdam (Holland)	XVth General Conference, International Union of Pure and Applied Chemistry.
Sept. 14-16 ..	"	ICSU	Copenhagen (Denmark)	General Assembly, International Council of Scientific Unions.
Oct. ..	"		Paris	Vth International Congress on Animal Husbandry
Oct. ..	"			VIIth Pacific Science Congress.
July 7- ..	1950		Amsterdam (Holland)	IVth International Congress of Soil Science.
Aug. 1 ..				
	1950	IUBS	Stockholm (Sweden)	General Assembly, International Union of Biological Sciences.
	1950		Stockholm (Sweden)	VIIth International Botanical Congress.
	1950	IUHS	Bucarest	International Congress of History of Science.
	1950	IUBS	Rio de Janeiro	Vth International Congress of Microbiology.
Probable July ..	1950		London (England)	IV World Power Conference.
Aug. 30- ..	1950		Cambridge (U.S.A.)	Congress International de Mathematiques.
Sept. 6 ..				
Sept. 8-17 ..	1951	IUC	Washington and New York (U.S.A.)	XIIth Congress and XVth Conference, International Union of Pure and Applied Chemistry.

By Courtesy of the Principal Scientific Officer, UNESCO Science Co-operation Office for South Asia, University Buildings, Delhi.

## LETTERS TO THE EDITOR

	PAGE		PAGE
Law of Additivity of Magnetic Susceptibilities in Hydrates—MATA PRASAD, S. S. DHARMATTI AND N. S. BIRADAR .. .. .	324	Addition Products of Anils with Metallic Chlorides—V. M. THAKOR AND R. C. SHAH	330
Note on <i>Nyctotherus cochlearis</i> Nov. SP., from <i>Rana curtipes</i> Jerdon—J. C. UTTANGI .. .. .	325	Amesite from Devarnarsipur, Bhadravathi, Mysore—M. G. CHAKRAPANI NAIDU ..	330
Catalysis of the Reaction Between Vanadate and Aromatic Amines Catalysed by the Oxalate ion—M. NARASIMHASASTRI	327	Schiff's Bases of 4-4'-Diaminodiphenylsulphide—M. RAGHAVAN, B. H. IYER AND P. C. GUHA .. .. .	330
Earthworms and Insects in Relation to Soil Fertility—J. G. SHRIKHANDE AND A. N. PATHAK. .. .. .	327	Oxidation of Cystine by Nitric Acid—H. S. R. DESIKACHAR .. .. .	331
Diphtheria Toxin in Submerged Culture with Aeration—PHANINDRANATH BASU AND DIPITISH CHAKRABORTY .. .. .	328	The Effect of Ultra-Violet Light on Colloidal Gold—B. K. BANERJI .. .. .	332
Influence of Sea Water on Protozoal Activity and Purification of Sewage by the Activated Sludge Process—S. C. PILLAI AND R. RAJAGOPALAN .. .. .	329	A New Method for the Conversion of Aromatic Carboxylic Acids into the Corresponding Aldehydes—H. P. GHADIALI, M. V. SHIRSAT AND R. C. SHAH.	332
		Synthesis of 4-Hydroxy-2-Phenyl-3-Acetylquinolines—T. B. DESAI, S. A. KULKARNI AND R. C. SHAH .. .. .	333
		Drought Resistance of Plants in Relation to Hysteresis in Sorption—K. SUBBA RAO, M. BHIMASENA RAO AND B. SANJIVA RAO.	334

## LAW OF ADDITIVITY OF MAGNETIC SUSCEPTIBILITIES IN HYDRATES

On the basis of Pascal's additivity rule, the susceptibility of a molecular combination is equal to the sum of the susceptibilities of the constituent molecules, provided no deformation takes place in the electronic orbits of the atoms of the combining molecules. It, therefore, follows that the susceptibility of a hydrate is the sum of the susceptibilities of the anhydrous salt and of the molecules of water of crystallisation. The data in this regard is, however, conflicting. Duchemin<sup>1</sup>, Zimens and Hedvall<sup>2</sup> and Varadachari<sup>3</sup> have found that the water of crystallisation in some hydrates behaves in an additive fashion, while the work of Raychaudhuri<sup>4</sup> and the earlier investigation of Zimens and Hedvall<sup>5</sup> show that the water of crystallisation does influence the susceptibility of the hydrates.

The authors determined the susceptibilities of a number of (1) anhydrous salts, (2) stable hydrates of these salts, and (3) several hydrates of the same salt containing varying molecules of water of crystallisation, in the solid state. The results, expressed in terms of  $-1 \times 10^{-6}$  c.g.s. units, are given in the following table. Deducting the observed molecular susceptibility of the anhydrous salt from those of the hydrates, values have been calculated for the susceptibility per molecule of water of crystallisation ( $\text{XH}_2\text{O}$ ) and are given in column 3. These values are widely different from the molecular susceptibility of water ( $12.96 \times 10^{-6}$ ) in the case of

almost all the hydrates, showing thereby that the hydrates generally do not obey the additivity law. Further in the several hydrates of the same salt, the departure from additivity is greatest in the hydrate containing the least number of molecules of water of crystallisation. Thus the deviations from the law, in all cases, depend upon the number of molecules of water associated with the molecule of the anhydrous salt. A graph drawn for the ratio of the weight of water to the weight of anhydrous salt against the deviation in the molecular susceptibility from additivity per molecule of water of crystallisation in the case of hydrates of several substances also supports the view-point that as the association of water molecules with an anhydrous salt increases the deviation from additivity decreases. These deviations have been explained on the basis of the binding forces between the anhydrous salt and the water molecules. It has been noticed that, in the case of several hydrates of the same salt, the heat of hydration per molecule of water of crystallisation (wherever available) increases as the number of molecules of water of crystallisation decreases. This shows that in hydrates containing least number of molecules of water of crystallisation the energy of binding between water molecules and molecules of the anhydrous salt is greater than in hydrates containing more water molecules. This observation supports the deduction mentioned above.

Raychaudhuri has found a relation between the percentage deviation in susceptibility from

additivity rule and the total heat of hydration of a hydrate. The results obtained by the authors do not substantiate such a relation. They, however, feel that there may be a relation between the deviation from additivity per molecule of water of crystallisation and the heat of hydration per mole.

The detailed discussion and results will soon be published elsewhere.

TABLE I

Substance	$\chi_m$	$\chi_{H_2O}$
$MgSO_4 \cdot 7H_2O$	135.50	11.96
$MgSO_4 \cdot 5H_2O$	108.70	11.39
$MgSO_4 \cdot H_2O$	60.78	9.02
$MgSO_4$	51.76	..
$CaSO_4 \cdot 2H_2O$	73.02	12.27
$CaSO_4 \cdot H_2O$	52.97	9.00
$CaSO_4$	48.47	..
$ZnSO_4 \cdot 7H_2O$	137.97	11.87
$ZnSO_4 \cdot H_2O$	63.34	8.46
$ZnSO_4$	54.83	..
$CdCl_2 \cdot 2H_2O$	98.68	15.43
$CdCl_2$	67.82	..
$SrCl_2 \cdot 6H_2O$	145.31	13.54
$SrCl_2$	64.05	..
$Ba(ClO_3)_2 \cdot H_2O$	112.80	9.35
$Ba(ClO_3)_2$	103.45	..
$Zn_3(PO_4)_2 \cdot 4H_2O$	165.00	10.37
$Zn_3(PO_4)_2$	123.50	..
$Na_2B_4O_7 \cdot 10H_2O$	225.70	14.52
$Na_2B_4O_7 \cdot 2H_2O$	115.33	17.41
$Na_2B_4O_7 \cdot H_2O$	98.69	18.19
$Na_2B_4O_7$	80.50	..
$BaBr_2 \cdot 2H_2O$	128.28	10.64
$BaBr_2 \cdot H_2O$	116.60	9.61
$BaBr_2$	106.99	..
$BaCl_2 \cdot 2H_2O$	100.16	12.79
$BaCl_2$	74.57	..
$3CdSO_4 \cdot 8H_2O$	292.40	14.65
$3CdSO_4$	175.16	..
$CdBr_2 \cdot 4H_2O$	148.73	15.20
$CdBr_2$	87.92	..
$SrBr_2 \cdot 6H_2O$	164.28	10.64
$SrBr_2$	100.40	..
$Na_2S_2O_3 \cdot 5H_2O$	121.62	11.83
$Na_2S_2O_3$	62.48	..
$K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	502.55	12.97
$K_2SO_4 \cdot Al_2(SO_4)_3$	191.05	..
$Al_2(SO_4)_3 \cdot 18H_2O$	321.20	12.78
$Al_2(SO_4)_3$	93.05	..

MATA PRASAD, S. S. DHARMATTI,  
AND N. S. BIRADAR.

Chemical Laboratories,  
Royal Institute of Science,  
Fort, Bombay.  
August 21, 1948.

1. Duchemin, E., *Compt. rend.*, 1934, **199**, 571. 2. Zimens and Hedvall, *Trans. Chalmers Univ. Technol. (Göteborg)*, 1942, **9**, 3-26. 3. Varadachari, *Proc. Ind. Acad. Sci.*, 1935, **2A**, 161. 4. Raychaudhuri, *Zeit. F. Phys.*, 1932, **7**, 393. 5. Zimens and Hedvall, *Svensk Kem. Tid.*, 1941, **53**, 12.

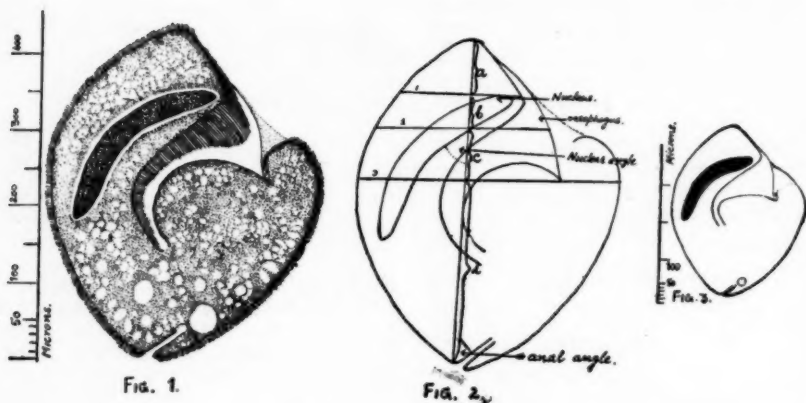
# NOTE ON NYCTOTHERUS COCHLEARIS NOV. SP., FROM RANA CURTIPIES JERDON

THE ciliate described here was found in the rectum of the frog, *Rana curtipes* Jerdon, collected in the forest near Castlerock (Goa frontier). Associated with it, other ciliates, such as *Nyctotherus macropharyngeus*, *Balanitidium helense* and *Opalina ranarum* were also found. Among these associated ciliates, the individuals of the new species, scanty in number, were conspicuous owing to their large body size and were visible to the naked eye, as small white vesicles. The body form and structure of the ciliate were noted in the living condition. Total preparations made by fixing with Bouin's fluid and staining with Ehrlich's haematoxylin, were used for microscopic study.

## NYCTOTHERUS COCHLEARIS NOV. SP.

The body in general outline, is somewhat three-sided. The dorsal surface is deeply convex as found in other species, but the ventral exhibits a protrusion in the middle, by which the third side is formed. The anterior and posterior poles however, are narrow and rounded. The peristomeal region being straight, looks truncated. Thus the body form resembles more or less a spoon with the handle broken off at the truncated part of the ciliate. If the ventral protrusion of the body is taken as an umbo, the form may very well be compared to a shell of a bivalve. Hence the name: *cochlearis*. The long and ellipsoidal nucleus, is one of the chief characteristic features of this new species, and is situated immediately over the cytopharynx, having a ratio of length to breadth 6 length. This long nucleus occupies the whole from the antero-dorsal to the antero-ventral surface of the body. The chromatin of the nucleus constitutes a number of compactly arranged and deeply stained round bodies. The micronucleus was not noted. The wide oesophagus leads into a narrow and curved cytopharynx, which ends in the middle of the posterior half of the body. The cilia, lining the oesophagus and the cytopharynx, are long and fine. Those on the body are short. A number of small and large vacuoles representing perhaps the food-vacuoles, were seen distributed all over the cytoplasm. The contractile vacuole is single, and lies at the posterior end.

Measurements in microns:—Body (length  $\times$  width) range 40-43  $\times$  31.5-33.5; Nucleus: (length  $\times$  width) 235  $\times$  40; Nuclear



*Nyctotherus cochlearis* nov. sp., from *Rana curtipes*.

*N. cochlearis*, showing the proportions of the various lengths as represented by *a*, *b*, *c* and *d*.

*N. cochlearis* nov. sp., as seen under the low power of microscope.

[*a*—the shortest distance between the macronucleus and the anterior extremity; *b*—the distance between the first line and the second passing through the middle of the oesophagus; *c*—the distance between the second line and the third passing through the terminal end of the oesophagus; *d*—the distance between the third line and the posterior extremity of the body.]

angle—48°; Anal angle—63°; Oesophagus 115; *a*=80; *b*=60; *c*=55; *d*=235.

In the recorded species of *Nyctotherus*, it can clearly be noticed that certain species have a definite tendency to attain exceptionally great lengths. Taking this character into consideration the species of *Nyctotherus* may be classified into three main groups, (1) giant, (2) intermediate and (3) small. Species like *N. magnus*, *N. vorax* and *N. gigantum*, etc., which range between 300-660 microns, may be included in the first group. Species as *N. ruber*, *N. macropharyngeus*, *N. cordiformis hylae*, *N. faberi*, *N. magnus malabarica*, etc., which lie between the giant and the small forms and range from 150-300 microns, come under the second group. The small species such as *N. termitis*, *N. paludicola*, *N. vulgaris*, *N. ochoterenai*, *N. duboisii*, etc., ranging between 90-150 microns, may be placed in the last group.

Obviously, the species under discussion, having large measurements, belongs to the first group, and may be compared with its allied species *N. magnus*, *N. vorax* and *N. gigantum*. Bez-

zenberger's *N. magnus* from *R. hexadactyla* (Asia), having a maximum of 660×460 microns, stands as the largest among the giant forms. It has a cytopharynx which is recurved at its end, whereas in the present species, this kind of curvature is absent. The nucleus in our species, is definitely ellipsoidal, but in *N. magnus*, it is flat and irregular. In the other species, namely *N. vorax*, described by Carini, from a Brazilian Girinos, it is ovoidal. *N. cochlearis* differs also from *N. magnus* and *N. vorax*, in the body form, which is kidney-shaped in the former and globular in the latter.

It thus differs from all the giant forms including even *N. gigantum*, which has a bean-shaped nucleus and an ovoidal body. Compared with the species of the other two groups, intermediate and small, our species differs from them, not only in the body measurements but also in the shape and size of the nucleus. For these reasons *N. cochlearis* should be considered a new species.

In conclusion the writer thanks Prof. P. W. Gideon, for providing all facilities during the

COMPARATIVE TABLE

	<i>N. magnus</i> Bezz	<i>N. vorax</i> Carini	<i>N. cochlearis</i> nov. sp.
Body size	660 × 460 mcr.	300-450 × 200-250 mcr.	400-430 × 315-335 mcr.
Body shape	Kidney-shaped	Globular	spoon-shaped
Nucleus size and shape	Flat and irregular	100 × 75 mcr., ovoidal	235 × 40 ellipsoidal
Cytopharynx	recurved at end	Funnel-like	Funnel-like
Nuclear angle	..	65°	48°
Anal angle	..	..	63°



course of this work, and Prof. Armando Manes, for suggesting the Latin name.

Dept. of Zoology, J. C. UTTANGI.  
Karnatak College,  
Dharwar,  
September 10, 1948.

1. Bezzenberger, E., 1904.
2. Phatia, B. L., 1936.
3. Carini, A., 1921, 1929, 1939, 1940.

### CATALYSIS OF THE REACTION BETWEEN VANADATE AND AROMATIC AMINES CATALYSED BY THE OXALATE ION

It has been previously reported that oxalate catalyses the reaction between dichromate and hydriodic acid<sup>1</sup> and dichromate and hydrobromic acid<sup>2</sup> and dichromate and aromatic amines.<sup>3</sup> Viswanatham and Gopalarao<sup>4</sup> have found that the oxalate ion has a profound accelerating action on the reaction between the vanadic

simultaneously and the time required for the appearance of blue violet colour was noted. In the absence of oxalate it took three minutes for the colour to appear, whereas when one ml. of N/10 oxalic acid was added (under otherwise identical conditions) the colour was immediately produced. The results with other amines experimented with are recorded in the following table.

All substances, (except benzidine), under test are dissolved in concentrated sulphuric acid and a known volume of the solution is treated with a known volume of decinormal vanadate solution and a requisite amount of water is added to bring up the volume of the reaction mixture to a total of 20 ml.

The author is grateful to Prof. G. Gopalarao for his valuable guidance in the work.

Chemical Laboratories, M. NARASIMHASASTRI.  
Andhra University,  
Waltair,  
September 21, 1948.

TABLE I

No.	Substance	Quantity and concn. of test soln.	Quantity of 0.1 N vanadate	Overall concn. of oxalate	Observation	
					without oxalate	with oxalate
1	Aniline	2 ml. of 1% soln.	2 ml.	$1 \times 10^{-2}$ N	Light green colour in ten minutes.	Slight green precipitate in 3 minutes.
2	Dimethyl-aniline	0.1 ml. of 2.5% soln.	1 ml.	$1 \times 10^{-2}$ N	Light orange colour in 30 minutes.	Orange colour in 2½ minutes.
3	Paratoluidine	2 ml. of 0.1% soln.	1 ml.	$1 \times 10^{-2}$ N	No change even in ten minutes.	Reddish brown colour in 5 minutes.
4	$\alpha$ naphthyl-amine	1 ml. of 0.1% soln.	1 ml.	$1 \times 10^{-2}$ N	Light pink colour after 8 minutes.	Pink colour in ½ minute turning reddish brown in 2 minutes.
5	Diphenyl-amine	0.1 ml. of 0.05% soln.	0.5 ml.	$0.5 \times 10^{-2}$ N	Blue-violet colour in 3 minutes.	Blue violet colour immediately.
6	Diphenyl-benzidine	0.1 ml. of 0.05% soln.	0.25 ml.	$0.5 \times 10^{-2}$ N	Light blue violet colour in 1 minute turning more intense in 2 minutes.	Intense blue-violet colour immediately.
7	Benzidine	5 ml. of 0.05% soln. in 10% acetic acid	0.1 ml.	$0.5 \times 10^{-2}$ N	Blue-violet colour immediately. A fine blue violet precipitate forms in 8 minutes which does not settle down even after thirty minutes.	A bulky violet precipitate in 1½ minutes which settles down almost immediately leaving the supernatant liquid colourless.

acid and the hydriodic acid. This catalytic influence of the oxalate ion has been utilised by them for the iodimetric estimation of vanadate.<sup>5</sup>

It is now found that oxalate markedly accelerates the reactions of a number of aromatic amines with vanadate also. The phenomenon has been studied by noting the time required for the appearance of the characteristic colour on reaction with vanadate in the presence and absence of oxalate. For example, 0.5 ml. of a decinormal solution of sodium vanadate is taken in a clean beaker and water is added to make the volume 20 ml. and 0.1 ml. of a 0.05% solution of diphenylamine in concentrated sulphuric acid was added and the mixture stirred quickly. A stop-watch was started

1. C. R. Viswanatham and G. Gopalarao, *Curr. Sci.*, 1942, 11, 102.
2. —, *Ibid.*, 1943, 12, 186.
3. —, *Ibid.*, 1944, 13, 47.
4. —, *Ibid.*, 1943, 12, 229.
5. C. R. Viswanatham, J. V. S. Ramanjaneyulu and G. Gopalarao, *Proc. Nat. Inst. Sci. India*, 1943, 11, 333.

### EARTHWORMS AND INSECTS IN RELATION TO SOIL FERTILITY

BESIDES producing general effects, viz., weathering of soil carried above the surface, the earthworms, and insects like termites and ants are known to bring about changes in the organic matter, mineral matter and structure of the

soil thus affecting its fertility. A few workers including Darwin,<sup>1</sup> Griffith,<sup>2</sup> Joachim & Kandiah,<sup>3</sup> Pendleton,<sup>4</sup> & Kalshoven<sup>5</sup> have studied the changes brought about by earthworms and termites selecting individual groups for their investigation but a review of the literature indicated that no comparative study of the changes brought about by them under similar environmental conditions and on the same land has ever been reported so far. The present communication deals with such a comparative study.

The material for this investigation was collected from a plot of land from a garden attached to the residential bungalow of the senior author. The samples were collected in August which recorded the heaviest rain-fall this year in Kanpur. The plot carries an old lemon tree with a trunk which is almost dead; the termite *Odontotermes* sp was found building its nests on this, ants were observed busy building their hills at the base of the same tree and the plot which carried weeds was full of earthworm casts. Samples were carefully collected from the centre of activity of the three organisms along with a composite sample of soil from different places in the plot which is about 1/10th of an acre. The air dried samples were then analysed by the standard methods.

The following table contains the analytical data :—

Determinations	Control Soil	Earthworm Casts	Termite Galleries	Ant Hills
pH ..	7.30	8.15	7.83	7.51
% Moisture on air dry soil ..	2.68	2.24	2.62	2.66
% Loss on ignition ..	3.29	4.35	3.14	3.04
% HCl-Insolubles ..	81.22	81.55	79.10	81.63
% Fe <sub>2</sub> O <sub>3</sub> ..	3.08	3.80	3.92	3.64
% Al <sub>2</sub> O <sub>3</sub> ..	6.79	4.65	6.76	7.25
% CaO ..	1.16	1.93	1.01	1.44
% MgO ..	0.58	0.47	0.73	0.44
% K <sub>2</sub> O ..	0.059	0.145	0.754	0.674
% P <sub>2</sub> O <sub>5</sub> ..	0.093	0.139	2.75	0.133
Total Exch. Bases (M.E.) ..	14.81	21.51	14.48	16.83
Exch. CaO ..	13.10	19.00	12.30	14.80
" MgO ..	0.025	0.056	0.020	0.015
" K <sub>2</sub> O ..	1.68	2.45	2.16	2.01
" P <sub>2</sub> O <sub>5</sub> ..	0.0023	0.0043	0.0011	0.0040
% C ..	0.536	1.980	0.576	0.880
% N ..	0.0068	0.1918	0.1022	0.1260
% Organic Matter ..	0.922	3.299	0.990	1.513
C/N ..	6.19	10.32	5.63	6.98

\* Organic Matter = Organic Carbon × 1.72

All the three increased the pH with the greatest shift by the earthworms. This is apparently due to the largest accumulation of lime in worm casts. The biggest loss on ignition of earthworm casts is in keeping with their highest organic matter content. The termite *Odontotermes* sp. active in this soil did not increase the availability of minerals as reported

by certain workers.<sup>6</sup> On the contrary it decreased the exchangeable bases with a serious decrease in lime and phosphorus. Similar decrease was recorded by Griffith<sup>2</sup> in Uganda and by Joachim & Kandiah<sup>3</sup> in Ceylon. Ants though second best in increasing the availability of minerals are much inferior to earthworms which increased the availability of minerals to considerable extent.

The Organic matter is increased nearly three and half times by the earthworms, one and half times by the ants with no increase by the termites. The availability of nitrogen in these soils is under investigation. On the whole of the three organisms studied, earthworms helped most in increasing the fertility of the soil followed by ants.

*Odontotermes* was of no consequence either in raising the organic matter status of the soil or in increasing the availability of minerals.

The details of the investigation will be pub-

J. G. SHRIKHANDI.

A. N. PATHAK.

Chemistry Section,  
Government Agricultural College,  
Kanpur,  
September 21, 1948.

1. *Vegetable Mould and Earthworms*, 1881. 2. *E. Afr. agric. Jour.*, 1938, 4, 70. 3. *Trop. Agriculturist*, 1940, 95, 333. 4. *Thai. Sci. Bull. Dept. Sci., Mins. of Econ. Affairs*. 5. *Tectona*, 1941, 34, 563. 6. *Nigerian Forester*, 1940, 1, 8.

## DIPHTHERIA TOXIN IN SUBMERGED CULTURE WITH AERIATION

JENNINGS and LINTON<sup>1</sup> obtained vigorous growth of *V. Cholerae* by utilisation of high percentage of sugar in a dilute broth by uniform and continuous aeration. Application of this principle was tried by us for production of diphtheria toxin. Recently Lingwood and Fenton<sup>2</sup> have published their observations on diphtheria toxin formation in submerged culture obtained by continuous shaking process.

A modification of Pope's medium was used by us for the experiments. Different quantities of glucose and maltose were tried. Park William Eight strain was used. Cultures were kept at 34-35° C. and continuous aeration was carried out by bubbling air through them. Toxin formation was optimum after 72 hrs. On the whole the results were comparable to those obtained by us in modified Pope's medium by the usual process. Activated charcoal appeared to improve toxin formation to some extent.

Details are under investigations.

Bengal Immunity Lab.  
Serum Department. PHANINDRANATH BASU.  
Calcutta, DIPTISH CHAKRABORTY.  
September 24, 1948.

1. *Archives Biochem.*, 1944, 3 & 4. 2. *Br. J. Exp. Path.*, 1947, 28, 354.

# INFLUENCE OF SEA WATER ON PROTOZOAL ACTIVITY AND PURIFICATION OF SEWAGE BY THE ACTIVATED SLUDGE PROCESS

In the course of our investigations on the occurrence, distribution and development of protozoa in the different Activated Sludge Plants ('diffused air' and surface aeration) in India, it was noted that certain species of marine *Vorticella* and *Zoothamnium* predominated in the sludge from the diffused aeration plant at Tuticorin which is operated with sea water due to acute shortage of fresh water.<sup>1</sup> The purification plant at Tuticorin is the only one of its kind in the world in being worked with sea water.<sup>2</sup>

The Tuticorin Activated Sludge Plant was installed in September 1928 to treat the sewage from a population of 3,000 persons at 15 gallons per head, and in recent years it has been dealing with a correspondingly increased volume of sewage as from a population of about 5,000. The purification plant has been functioning very efficiently since the start; the effluent from the settling tank has always appeared brighter and cleaner than the sea water taken into the works for use (e.g., the sea water contained 3.948% total solids and 0.616% organic matter, i.e., loss on ignition, and the corresponding figures for the effluent are 3.936% and 0.584%; the chloride

case of *Carchesium*, are continuous with the thread in the main stalk, causing all of the zooids to contract together.

Studies have shown that when the *Vorticellids* in the above sludge are selectively rendered inactive or killed out (by employing heat or other sterilising agents), the clarification of sewage is adversely affected and eventually stopped; that the rate of clarification is closely dependent on the number of active *Vorticellids* in the medium.

Apart from our observations, there is no record of the occurrence of *Zoothamnium* sp. in any artificial system of sewage purification. It may also be noted that Bhatia has not recorded *Zoothamnium* from Indian waters.<sup>3</sup> *Zoothamnium* sp. has been reported from Niagara River.<sup>4</sup> More recently, certain species of *Zoothamnium* has been noticed in the mouths of the brackish-water fish, *Acentrogobius neilli* (Day) occurring in the Buckingham Canal, Madras, and has also been obtained from the stomach-contents of fishes such as *Therapon jarbua*.<sup>5</sup>

Our thanks are due to Prof. V. Subrahmanyam and Dr. Gilbert J. Fowler for their valuable criticism and for kindly making arrangements for our visits to the Activated Sludge Plant at Tuticorin; to Messrs. Madura Mills Co. Ltd., for kindly sending us samples of activated sludge from time to time and for the facilities placed at our disposal during our visits to Tuticorin; and to Dr. B. R. Seshachar, Central College, Bangalore, for kindly taking the photomicrographs of the protozoa and confirming the identification of the organisms.

Dept. of Biochemistry, S. C. PILLAI.  
Indian Institute of Science, R. RAJAGOPALAN.  
Bangalore,  
September 24, 1948.

1. Pillai, S. C., *Curr. Sci.*, 1942, 11, 437.
2. Private communication from Dr. Gilbert J. Fowler, formerly Representative of Messrs. Activated Sludge Ltd. in India and the East.
3. Bhatia, B. L., "The Fauna of British India, including Ceylon and Burma: Protozoa; Ciliophora," 1936, p. 398, Taylor and Francis, Ltd.,
4. Ward, H. B., and Whipple, G. C., "Fresh-water Biology," First Edition, 1918, p. 294, John Wiley and Sons, Inc.
5. Jones, S. and Job, T. J., *Curr. Sci.*, 1938, 6, 558.



FIG. 1. A cluster of marine species of *Vorticella*  $\times 115$ .



FIG. 2. A colony of *Zoothamnium* sp.  $\times 115$ .



FIG. 3. Two individuals of the colony of *Zoothamnium* sp. enlarged  $\times 675$ .

Photomicrographs of the marine species of *Vorticella* and *Zoothamnium* occurring in the Activated Sludge at Tuticorin, where sea water is used for flushing purposes. (Reduced to  $\frac{1}{4}$ )

contents of both were just the same). The clotting and clarifying action of the sludge and its settling property are as remarkable as those of activated sludge formed in other aeration tanks operated with fresh-water.

Observations over a period of eight years have shown that the outstanding feature of the activated sludge produced with sea water is the active presence of a large number of certain species of marine *Vorticella* (*Vorticella marina* and other forms) and *Zoothamnium* sp., one ml. of the mixed liquor containing 8,000 to 18,000 active protozoan cells depending upon the concentration of sludge (the other forms of protozoa, mostly small ciliates, in the sludge are relatively few). Two of the commoner species of these *Vorticellids* are shown in Figures 1-3. Figs. 2 and 3 show the distinctive feature of *Zoothamnium*, viz., the contractile threads from the lateral branches of the colony, unlike in the



### ADDITION PRODUCTS OF ANILS WITH METALLIC CHLORIDES

In course of some synthetic work for the preparation of ethyl acetoacetate-anil, ethyl acetoacetate was reacted with aniline in presence of fused zinc chloride. On working up the reaction product a well-defined crystalline compound was obtained which melted above  $240^{\circ}\text{C}$ . over a wide range and with decomposition. The same product was obtained from ethyl acetoacetate-anil and zinc chloride and was found to be the addition product of the anil and zinc chloride,  $\text{C}_{11}\text{H}_{15}\text{O}_2\text{N}$ ,  $\text{ZnCl}_2$ , as on decomposition with sodium carbonate it gave the anil which by Conrad and Limpach's method<sup>1</sup> could be converted to 4-hydroxy-2-methylquinoline. Similar addition products were also obtained from the anil and cadmium and mercuric chlorides. No such addition product of anils appears to be known in literature.

Ethyl  $\alpha$ -methylacetoacetate-anil gave similar addition products with zinc and mercuric chlorides. Anils from *o*-anisidine and *o*- and *p*-toluidines and ethyl acetoacetate also gave addition products with zinc and cadmium chlorides. Acetophenone-anil and benzaldehyde-anil however, failed to give any addition product with zinc chloride and got hydrolysed yielding aniline-zinc chloride. Hence the formation of addition products with the above metallic halides appears to be the property of anils of  $\beta$ -ketonic esters only, and would be useful for isolation of anils from an impure mixture and for their characterisation.

Detailed account of the work will be published elsewhere.

Org. Chem. Labs., V. M. THAKOR.  
Royal Institute of Science, R. C. SHAH.  
Bombay,  
October 25, 1948.

1. Conrad and Limpach, *Ber.*, 1887, 20, 947; Limpach, *Ber.*, 1931, 64, 969; Hughes and Louis, *J. Proc. Roy. Soc., N. S. Wales*, 1938, 71, 458; Cavallito and Haskell, *J. Am. Chem. Soc.*, 1944, 66, 1166.

### AMESITE FROM DEVARNARSIPUR, BHADRAVATHI, MYSORE

In a petrographic collection made by Dr. C. S. Pichamuthu from Devarnarsipur, in the year

1943, occurs an interesting type of rock, which at first sight appears to be an amphibolite. But, on closer examination, it is found to be a chlorite-tourmaline rock. As the chlorite found in this rock appears to be particularly interesting, this mineral has been subjected to a detailed investigation of its optical characters and chemical composition and the main conclusions are recorded below. The chlorite is amesite and the tourmaline is schorlite. The analysis of the amesite<sup>1</sup> is given here and is compared with two others described by Shannon and Pisani.<sup>2</sup>

The optical characters of the amesite as compared with that, described by Shannon, from Chester, are as follows:—

Devarnarsipur	Chester <sup>3</sup>
(+) $2V = 0^{\circ}$ to $15^{\circ} 45'$	(+) $2V = 0^{\circ}$
$N_g = 1.590$	$N_g = 1.612$
$N_m = 1.585$	$N_m = N_p = 1.597$
$N_p = 1.575$	$N_g - N_p = .015$
$N_g - N_p = .015$	
Pleochroic	Colourless

The Mysore amesite differs from that of Chester in being pleochroic,  $X=Y$ = pale green,  $Z$ = colourless and showing a character varying from uniaxial to biaxial, with a maximum optic axial angle  $2E=26^{\circ}$  (calculated to  $2V=15^{\circ} 45'$ ), measured on the Fedorov's stage. The silica percentage of the Mysore amesite is higher than that given by Shannon and Pisani. Pisani's formula for amesite, which has been adopted by Winchell, is  $\text{H}_2\text{Mg}_2\text{Al}_2\text{Si}_2\text{O}_{10}$ .<sup>4</sup> Since silica is known to replace alumina in the structure of these minerals, Pisani's formula for amesite may be modified for Mysore amesite as  $\text{H}_4(\text{Mg}, \text{Fe}, \text{Mn})_2(\text{Si}, \text{Al})_2\text{O}_{10}$ .

Plotted on the linear diagram proposed by Hammond<sup>5</sup> for chlorite minerals, the Mysore amesite has  $\text{RO} : \text{SiO}_2 = 296$  and  $\text{R}_2\text{O}_3 : \text{SiO}_2 = 127$ , and lies in the amesite field.

Dept. of Geology, M. G. CHAKRAPANI NAIDU,  
Central College,  
Bangalore,  
October 18, 1948.

1. Analyst—E. R. Tirumalachar, Chemist, Mysore Geological Department. 2. *American Journal of Science*, 1920, 49, 96. 3. *Op. cit.* 2 above. 4. *American Mineralogist*, 1936, 21, 642. 5. *The Mineralogical Magazine*, 25, No. 167, 454.

### SCHIFF'S BASES OF 4-4'-DIAMINODIPHENYLSULPHIDE

THE high antibacterial activity of 4-4'-diaminodiphenyl sulphone and sulphanilamides has led to the belief that the molecular grouping essential for chemotherapeutic activity is the

$\text{>N}-\text{C}_6\text{H}_4-\text{S}-\text{Complex}^{1,2}$  Raiziss, et al.<sup>3</sup> reported that, although the therapeutic properties of 4-4'-diaminodiphenylsulphide and its acetyl derivative compared favourably with those of sulphanilamide, their high toxicity

	Devarnarsipur	Pisani	Shannon
$\text{SiO}_2$	28.60	21.40	20.95
$\text{Al}_2\text{O}_3$	31.02	32.30	35.21
$\text{Fe}_2\text{O}_3$	Nil	Nil	Nil
$\text{FeO}$	4.80	15.80	8.28
$\text{MgO}$	23.44	19.90	22.88
$\text{CaO}$	Nil		0.58
$\text{MnO}$	0.37		traces
$\text{H}_2\text{O}^+$	11.90	10.90	13.02
$\text{H}_2\text{O}^-$	0.27		0.23
	100.40	100.80	101.15

precluded their clinical use. The Schiff's bases of sulphanilamides and N'-substituted sulphanilamides have all been found to be very effective against bacterial infections.<sup>4</sup>

Considering the above facts it was thought worthwhile to synthesise a few typical Schiff's bases (Type A) of 4,4'-diaminodiphenyl sulphide for testing their antibacterial activity. The Schiff's bases (Table I) have been prepared by reacting 4,4'-diaminodiphenyl sulphide with appropriate aldehydes in alcoholic solution and in the presence of condensing agents like zinc chloride. The resulting compounds have been crystallised from alcohol. They have been characterised and listed in Table I.

TABLE I

General formula Type A.  $RCH=N-\text{C}_6\text{H}_4-S-\text{C}_6\text{H}_4-N=CH\cdot R$ . R = aldehyde residue.

No.	Aldehyde used	M.P. °C.
1	Benzaldehyde	176-177
2	m-Nitrobenzaldehyde	159-160
3	p-Dimethylamino benzaldehyde	231-232
4	p-Diethylamino benzaldehyde	155-156
5	Salicylaldehyde	207-208
6	Anisaldehyde	204-205
7	Piperonal	175-176
8	Cinnamaldehyde	178-179
9	Furfural	103-104

Details will be published elsewhere.

Organic Chem. Laboratories, M. RAGHAVAN,  
Dept. of Pure & App. Chemistry, B. H. I. & R.  
Ind. Inst. of Science, P. C. GUHA.  
Bangalore.  
October 26, 1948.

1. Green and Bielchowsky, *Brit. J. Expt. Path.*, 1942, 23, 13. 2. Fourneau, et al., *Compt. rend. Soc. Biol.*, 1938, 127, 391. 3. Raiziss, et al., *J. Amer. Chem. Soc.*, 1939, 61, 2763. cf. *Proc. Soc. Expt. Biol. and Med.*, 1938, 39, 339. 4. Molitor and Robinson, *J. Pharmacol.*, 1939, 65, 405.

## OXIDATION OF CYSTINE BY NITRIC ACID

BLUMENTHAL and CLARKE<sup>1</sup> found that nitric acid oxidises cystine sulphur to sulphuric acid. Evans<sup>2</sup> adopted this method for the estimation of cystine in food materials by conversion to sulphate and estimating the latter as barium sulphate. He, however, observed that with pure cystine only about 62% of the cystine could be recovered as sulphate. Addition of

dextrose, soya-bean meal or fish meal along with the cystine increased the recovery to 92-98%. The following note relates to some observations made on the above reaction.

It was first observed that however long the reaction mixture of cystine and nitric acid be heated on the water-bath, the percentage recovery of cystine as sulphate was incomplete. It varied from 62.1% to 66.3%. If after heating the reaction mixture for 24 hours as suggested by Evans, dextrose be added to the reaction mixture and it is further heated for 6-8 hours, 93.6% of the cystine sulphur could be oxidised to sulphate. This experiment showed that incomplete recovery of cystine as sulphate was due to incomplete oxidation and not due to loss of cystine sulphur as oxides of sulphur during the oxidation with nitric acid.

The following table shows the effect of addition of various substances to the cystine prior to oxidation on the conversion of cystine sulphur to sulphate sulphur.

From the results (see table) it can be postulated that during the oxidation of the (-S-S-) linkage of cystine by nitric acid about 1/3 of the cystine is converted to one or more intermediate oxidation products which resist complete oxidation to sulphate by nitric acid alone. Any type of organic matter which can reduce nitric acid to lower oxides of nitrogen if added to the reaction mixture in the beginning of the reaction or at any later stage of the reaction, can catalyse the complete oxidation of these intermediate products to the sulphate stage. The fact that even inorganic substances like copper, zinc or tin which reduce nitric acid to oxides of nitrogen are capable of acting in a way similar to organic materials has to be interpreted to mean that the further oxidation of the intermediate products is brought about by the intervention of the oxides of nitrogen. Further examination of the filtrate from the Barium sulphate precipitation mixture would reveal the nature of the intermediate oxidation products.

The author's thanks are due to Dr. V. Subrahmanyam and Dr. M. R. Aswathanarayana Rao for their interest in the work.

Dept. of Biochemistry, H. S. R. DESIKACHAR,  
Indian Institute of Science,  
Bangalore,  
October 30, 1948.

1. Blumenthal, D., and Clarke, H. T., *Jour. Biol. Chem.*, 1935, 110, 343. 2. Evans, R. J., *Arch. Biochem.*, 1945, 7, 439.

Note.—0.1 g. samples of cystine were taken for each estimation. 2g of lactose, glucose starch, and butter fat were added along with the cystine during the digestion. The amounts of carbon, zinc, copper, and tin added along with the cystine were 1.5 g. in each case.

	Substances added								
	Control	Glucose	Lactose	Starch	Butter fat	Pure carbon	Copper	Tin	Zinc
Cystine recovered as sulphate	63.8%	95.2%	94.5%	95.8%	95.7%	96.9%	95.2%	96.7%	97.1%

### THE EFFECT OF ULTRA-VIOLET LIGHT ON COLLOIDAL GOLD

In a series of studies on the action of ionizing radiations on colloids, Crowther and Fairbrother<sup>1</sup> came to the conclusion that only positively charged colloids are coagulated by X-rays whereas negatively charged colloids are unaffected. As a cause of this phenomenon they have suggested that it is due to the gradual discharge of the charged colloidal particles by the ionisation produced in solution during the passage of the radiation. Lal and Ganguly<sup>2</sup> made a comprehensive study on the effect of ultra-violet light on colloids and observed that both positively and negatively charged colloids are affected. They assumed that coagulation was due to the photochemical decomposition of the stabilizer. Further evidence of the photochemical nature of the change has been given by Desai and others,<sup>3</sup> Ellinger,<sup>4</sup> and Haines.<sup>5</sup>

In the present communication, a study has been made with colloidal gold prepared in four different ways, viz., with formaldehyde, tannic acid, hydrazine hydrate and ethereal solution of phosphorus. These sols were exposed to an "Alpine Sun" ultraviolet lamp for various periods of time and it was found that sols prepared with formaldehyde and hydrazine hydrate only coagulated whereas sols prepared with tannic acid and phosphorus remained unaffected.

Electrical conductivity of these sols were measured with different periods of exposure as recorded in the table below:

TABLE I  
Sol prepared with formaldehyde

Time of exposure	Sp. conductivity $\times 10^4$
0 hr.	3.57 mho
3 hrs.	3.68 mho
8 hrs.	3.68 mho
16 hrs.	3.68 mho
(coagulated)	(coagulated)

TABLE II  
Sol prepared with hydrazine hydrate

Time of exposure	Sp. conductivity $\times 10^4$
0 hr.	3.65 mho
5 hrs.	3.65 mho
8 hrs.	3.57 mho
16 hrs.	3.55 mho
21 hrs.	3.55 mho
(coagulated)	

It may be seen from the tables that the electrical conductivity of the formaldehyde sol increases with time of exposure whereas that of hydrazine hydrate sol decreases. Carruthers and Norrish<sup>6</sup> have shown that the primary product of photo-decomposition of formaldehyde is formic acid. With the formation of

formic acid the hydrogen-ion concentration of the system increases and hence the increase in conductivity. Brav and Cuy<sup>7</sup> have shown that the strength of dilute solutions of hydrazine hydrate decreases rapidly in presence of air. Gilbert<sup>8</sup> has shown that the presence of alkali increases the rate of oxidation and that greater the surface present the greater the oxidizing action. Since colloidal gold is slightly alkaline and a large amount of surface to present in the colloid, the hydrazine hydrate is quickly decomposed into nitrogen and hydrogen as observed by Elgin and Taylor.<sup>9</sup> The decrease in electrical conductivity and the instability of the sol formed with hydrazine hydrate is, thus, explained. Further details will be published later.

My thanks are due to Principal Dr. P. B. Ganguly, D.Sc., F.N.I., for valuable suggestions and guidance and the Govt. of Bihar for the award of a research scholarship.

Physico-Chem. Laboratories,  
Patna Science College, B. K. BANERJI.  
Patna,  
October 26, 1948.

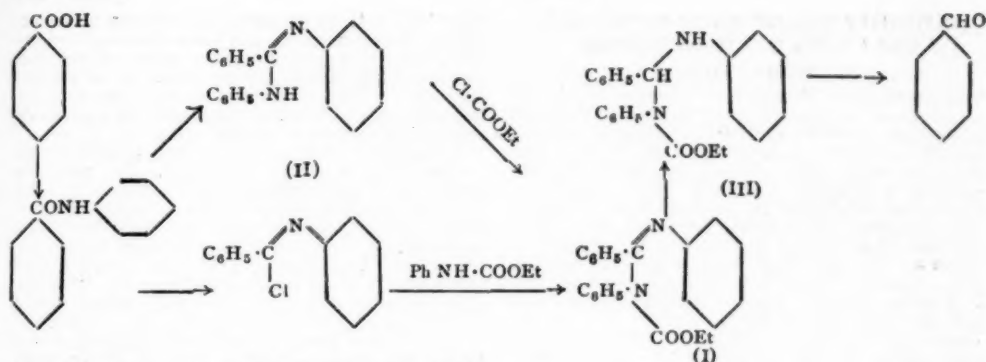
1. *Phil. Mag.*, 1927, **4**, 325; *ibid.*, 1928, **6**, 386.
2. *J. I. C. S.*, 1929, **6**, 547; *ibid.*, 1930, **7**, 513. 3. *Curr. Sci.*, 1934, **3**, 105. 4. *Nature*, 1936, **138**, 1014. 5. *ibid.*, 1937, **139**, 32. 6. *J. C. S.*, 1936, 1036. 7. *J. A. C. S.*, 1924, **46**, 1786. 8. *ibid.*, 1929, **51**, 2744. 9. *ibid.*, 1929, **51**, 2059.

### A NEW METHOD FOR THE CONVERSION OF AROMATIC CARBOXYLIC ACIDS INTO THE CORRESPONDING ALDEHYDES

SHAH AND ICHAPORIA<sup>1</sup> observed that benzanilide imidochloride condensed with urethane to give N-phenyl-N'-carbethoxybenzamidine which suffered ring closure on heating furnishing 4-hydroxy-2-phenylquinazoline, this being a novel synthesis of such quinazoline derivatives. In continuation of this work phenyl urethane was condensed with benzanilide imidochloride. The resulting N : N'-diphenyl-N'-carbethoxybenzamidine (I), which could also be obtained by the reaction of N : N'-diphenylbenzamidine (II) with ethyl chloroformate, however, resisted all attempts at ring-closure.

During the study of the properties of this N-carbethoxybenzamidine (I) it was observed that it could be reduced by aluminium amalgam in moist ether or preferably in ethyl acetate to dihydrobenzamidine (III) which could readily be hydrolysed by cold dilute acid to benzaldehyde. This affords a new method for the conversion of an aromatic carboxylic acid to the corresponding aldehyde.

The following method essentially depends on the reduction of the N-carbethoxybenzamidine to the dihydro compound. Merling<sup>2</sup> observed that amidines derived from hydroaromatic acids can be reduced to diphenylmethylenediamine bases which on hydrolysis would yield the corresponding aldehydes. Sidiki and Shah,<sup>3</sup> however, have noted that in amidines derived



from aromatic acids -C=N-group cannot be reduced to -CH-NH- group. It would appear therefore that in the present case, the reduction is made possible on account of the presence of the N-carbethoxy group.

This new method has been applied to convert benzoic acids with various substituents like halogen, methyl, hydroxy, methoxy in ortho-, meta-, and para-positions, to the corresponding aldehydes and has been found of general applicability giving good yields at various stages.

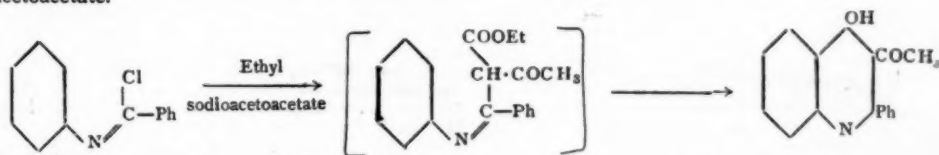
H. P. GHADIALI.  
M. V. SHIRSAT.  
R. C. SHAH.

Royal Institute of Science,  
Bombay.  
October 4, 1948.

1. Shah and Ichaporia, *J. Chem. Soc.*, 1936, 431.
2. Merling, *Ber.*, 1908, 41, 2064.
3. Shah and Sidiki (unpublished work).

### SYNTHESIS OF 4-HYDROXY-2-PHENYL-3-ACETYLQUINOLINES

IN continuation of the previous work<sup>1,2</sup> reported from this laboratory on the application of anilide imidochlorides to the syntheses of heterocyclic compounds, the condensation of benzanilide imidochloride with ethyl sodioacetate has now been studied. The condensation of benzanilide imidochlorides with ethyl sodiomalonate<sup>3,1</sup> is known to give mono ethyl  $\alpha$ -(phenyliminobenzyl) malonates, which can be cyclised by heating to 4-hydroxy-2-phenyl-3-carbethoxyquinolines. No work however appears to have been done on the condensation of benzanilide imidochloride with ethyl sodioacetate.



The condensation of benzanilide imidochloride with ethyl sodioacetate has afforded an uncrystallisable intermediate condensation product namely, ethyl  $\alpha$ -(phenyliminobenzyl)-acetate, which has been subsequently cyclised by heating under reduced pressure to give the hitherto unknown 4-hydroxy-2-phenyl-3-acetylquinoline.

The method of synthesis is quite general and has been extended to other substituted anilide imidochlorides and the corresponding 4-hydroxy-2-aryl-3-acetylquinolines, which are otherwise inaccessible, have now been prepared.

Detailed account of the above work will shortly be published elsewhere. This work is being extended to various other  $\beta$ -ketonic esters and  $\beta$ -diketones.

The authors are grateful to the Chemical Society for a research grant for this investigation.

T. B. DESAI.

Royal Institute of Science,  
Bombay.

R. C. SHAH.

October 4, 1948.

1. Shah and Heeramanek, *J. Chem. Soc.*, 1936, 428.
2. Shah and Ichaporia, *ibid.*, 431.
3. Just, *Ber.*, 1885, 18, 2025; 1886, 19, 983, 1452 1541.



### DROUGHT RESISTANCE OF PLANTS IN RELATION TO HYSTERESIS IN SORPTION

THE problem of drought resistance of plants is of great economic importance. Attempts have been made by earlier workers to correlate drought resistance with the size of the stomata and cells of leaves<sup>1</sup> and certain specific properties of the protoplasm<sup>2</sup> of the leaves of plants. In spite of these attempts, no satisfactory correlation has yet been possible and the nature of drought resistance is obscure. It has been shown in the earlier investigations from this laboratory that the water retaining property of the soils<sup>4</sup> and gels of hydrous oxides<sup>5</sup> is mainly dependent upon the capillary structure. The present investigation was prompted by the idea that the capillary structure of the leaf tissue is probably a major factor in determining the degree of drought resistance of plants.

Balsam, Grass, Paddy, Ragi, Wheat and Oats were chosen for the study. The leaves of these plants were subjected to successive dehydration and hydration at 30° C. in a quartz fibre spring balance.<sup>2</sup>

The hysteresis effect is exhibited by all the systems and the hysteresis loop disappears after a certain number of hydration and dehydration operations. These investigations show that the capillaries of the leaf are made up of fairly rigid walls. The cavities with constricted necks<sup>3</sup> entrap water during dehydration and cause hysteresis in the earlier stages.

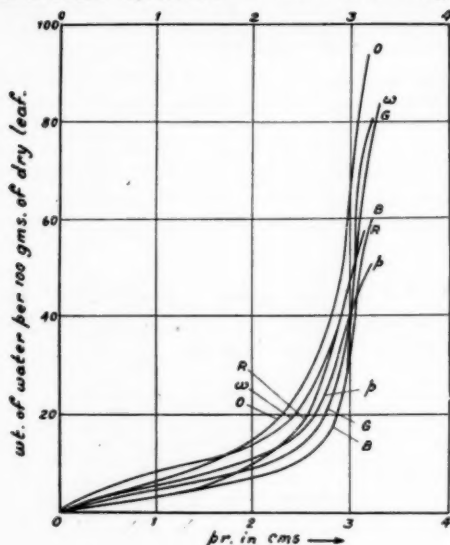


FIG. 1

Hydration isotherms of the leaves of Balsam (B), Grass (G), paddy (P), Ragi (R), wheat (W) and Oats (O).

The leaf can thus retain a larger amount of water during dehydration than during hydration. The entrapping effect seems to be due to the rigidity of the cavity wall. It is likely that the rigidity of the leaf tissue is a factor of importance in enabling the plants to conserve water during periods of drought.

The hydration isotherms of the leaves of the six plants are shown in Fig. 1. The relative positions of the isotherms indicate that in the relative humidity range of 0.5 to 0.95 the six plants show a gradation in the water holding capacity. At any particular relative humidity in this range, Balsam takes the lowest and Oats the highest amount of water. The six plants can be arranged in the increasing order of drought resistance as follows: Balsam, Grass, Paddy, Ragi, Wheat and Oats—Balsam being the least and Oats the most drought resistant. In accordance with the cavity theory of Hysteresis in Sorption,<sup>3</sup> there is in Balsam a preponderance of wider cavities and in Oats of narrower ones.

As the leaf is subjected to successive hydration and dehydration a marked fall in the hydration capacity at the saturation pressure is noticeable during the later stages of the operation. This indicates that as a result of a number of dehydrations, the protoplasm of the leaf gets denatured and suffers an irreversible loss in hydrophilic character.

The smallest cavity neck radii in the leaves of Balsam, Grass, Paddy, Ragi, Wheat and Oats are 21.8, 18.0, 16.2, 16.2, 13.6 and 7.5 Å respectively. The wider the cavity neck, the greater the ease with which water is lost by the cavity. Of the six plants the smallest neck radius in the balsam leaf which is most sensitive to drought is greater than that in Oats, the most drought resistant. The smallest neck radii of leaves of other plants are intermediate between these two values. This gradation conforms to that indicated by the hydration isotherms.

The study of hydration-dehydration hysteresis with the leaves of different plants affords a new line of approach to the highly complex problem of drought resistance in plants. It definitely indicates a correlation between the drought-resisting property of the plant and the capillary structure of its leaf.

Chemistry Department, K. SUBBA RAO.  
Central College, M. BHIMASENA RAO.  
Bangalore, B. SANJIVA RAO.  
November 11, 1948.

1. Maximov, "The Plant in Relation to Water."—A study of physiological basis of drought resistance. George Allan & Unwin Ltd., London, 1929, p. 297. 2. Rao, K.S., *J. Phys. Chem.*, 1941, **45**, 500-531. 3. —, *Curr. Sci.*, 1940, **9**, 68. 4. Sorada Gulvady, K. Subba Rao and B. Sanjiva Rao, *Proc. Ind. Acad. Sci.*, 1947, **25**, 229. 5. Schmidt Diwald and Socker, *Planta*, 1941, **31**, 569.

This investigation is a part of the programme of research work supported by the National Institute of Sciences of India by the award of a Senior Research Fellowship to one of the authors (K. Subba Rao, D.Sc.).

## REVIEWS

**Kunstliche New Elemente.** By Otto Hahn. (Verlag Chemic, GMBH Weinheim/Berstrasse, Berlin), 1948. Pp. 50. Price D. M. 2-50.

The discovery of the fission of uranium and the possibility of chain reaction led Fermi to the development of a device now known as the "Uranium Pile" in which the chain reaction could be controlled and sustained. Such a pile serves as an extremely powerful source of neutrons with the help of which it has now become possible to prepare weighable quantities of any element (stable or radioactive) by artificial transformation. This monograph contains a brief account of eight new elements which are of great interest from the chemical point of view. It has been written by one who is an authority on nuclear chemistry.

The book is roughly divided into five sections. In the introductory section, the author traces the history of the development of nuclear physics. In the succeeding section, starting with the early experiments on the neutron bombardment of the heavy elements, especially uranium and thorium, carried out by Fermi on the one hand and by Hahn, Meitner and Strassmann, on the other, the author describes the crucial investigations of Hahn and Strassmann and of Curie and Savitch which finally culminated in the discovery of the fission of the uranium nucleus into roughly two equal parts. The discovery of the emission of secondary neutrons following uranium fission and the possibility of a chain reaction are discussed in the third section. The essential details of the construction and working of the "Uranium pile" are also given in the same section. The fourth section is on artificially prepared new elements. The various methods of preparation in small as well as in large quantities and the properties of eight new elements are given.

They are:—

(1) element 43, Technetium (Tc), (2) element 61, (3) element 85, Ekaiodine or Astatine (At), (4) element 87, Francium (Fr), (5) element 93, Neptunium (Np), (6) element 94, Plutonium (Pu), (7) element 95, Americium (Mm) and (8) element 96, Curium. (Cm).

In the concluding section, the author has given some pertinent remarks on the position which the transuranic elements occupy in the periodic system.

The subject-matter of the book is presented in a simple and easily readable form. The book though written in German will be very handy for workers in the field of nuclear physics.

R. S. K.

**One Story of Radar.** By A. P. Rowe. (Cambridge University Press, Cambridge), 1948. Pp. xii + 208. 8sh. 6d. net.

The years since the close of World War II have been remarkable for the number of popular and semi-popular books on atomic bombs and nuclear energy. This over-emphasis on one aspect of research has been responsible, more than any other single factor, for the impression steadily gaining ground in the

public mind that scientific endeavour, irrespective of the motive urging the investigators, spells speedier march towards the destruction of modern civilization, if not of mankind. 'One Story of Radar' tends to correct this impression by presenting the picture in its proper perspective. It is worthwhile noting here that the author is of opinion that "few in a position to judge would hesitate to name the cavity magnetron as having had a more decisive effect on the outcome of the war than any other single scientific device evolved during the war. It was of far more importance than the atomic bomb, which had no effect at all on the outcome of the German war and contributed rather to the shortening of the Japanese war than to its result," and that "Had there been a scientist in the Victory Parade, he might well have carried on his banner the inscription: 'My profession saved a million lives.'"

The book traces the history during the fateful decade following 1935, of the fortunes and vicissitudes of the Telecommunications Research Establishment (T.R.E.) in its wanderings from the lovely "Island"—actually an isthmus—of Orfordness and its neighbour the Bawdsey Manor on the east coast of England through Worth Matravers and Swanage in the South to Malvern College in central England, with a depressing but brief halt at northern Dundee thrown in between. The narrator is its own Chief Superintendent. The progress achieved by T.R.E. within this period can be gauged to some extent by observing that the Establishment which started by demonstrating a radiolocation gadget "that could measure the height of an aircraft flying at 7,000 ft. with an error of little more than 1,000 ft." was responsible eight years later for placing at the service of the Bomber Command a device known as the Oboe whose operators "sitting in comfort in England, could follow with great accuracy the track of an aircraft as it flew over a target 250 miles away, could calculate its speed" and could signal it when to release the bomb load on the target with an error not exceeding a few hundred feet. The thousand bomber raids over the Ruhr area in 1942-43 could not have been successfully organised without the aid of an appliance such as the Oboe. This progress followed closely on the heels of the development of Oliphant's klystron and the magnetron, the two devices that pushed the shortest wavelengths at which electro-magnetic waves could be usefully handled and generated from a couple of meters in 1935 to a few centimeters by 1942. The measures and counter-measures adopted in the Bay of Biscay submarine warfare indicate that that struggle might appropriately be termed the battle of wave lengths in which the contestants were the scientists of the opposing sides.

The author makes no attempt whatever to weary the reader by dwelling on the technical details pertaining to radar appliances, as there is an abundance of literature on such

topics available elsewhere to the inquirer so interested.... On the other hand, he gives an eminently readable account of the circumstances and the military need that gave birth to the idea of a new radar appliance, of the pursuit of that idea and its subsequent culmination in the form of a laboratory instrument, of the conference table at which Civilian Scientists and Military Chiefs had to decide whether the baby instrument should die without a progeny or be permitted to evolve into a prolific race of factory built models and in the latter event, of the modifications to be incorporated so as to meet the requirements not only of large-scale production methods, but also of a modicum of secrecy and finally of its use in military operations and the part it played in shaping the future course of War. The success of such a scheme depended on the speedy and whole-hearted mingling of the variegated patterns of mind and habit of the men concerned. It is therefore not surprising that the author does not tire of repeating the importance of the creation of team-spirit among the workers of T.R.E. or of the unceasing effort that T.R.E. made to interpret the scientist to the user and the user to the scientist. As he truly observes, "the war might well have taken a different course and would certainly have cost us more dearly if the Service user and the radar scientist had got together in Germany as they did in this country."

It was inevitable that these men should resort to some method of relieving the intense emotional strain under which they lived and worked. That one of these methods was the christening of their creations by odd yet piquant names reveals a human and lovable side to their character. To give a few instances, the Plan Position Indicator that enabled the pilot to home on to a target was named H<sub>2</sub>S—abbreviation for Home, Sweet Home, we are told—(not for the nasty smelling gas?); the components of the Oboe, whose tunes wafted the aircraft to its destined target, were named the Cat and the Mouse; the Eureka and the Rebecca were the names selected respectively for the Radio Beacon established by the landed paratroops and for the receiver installed on the aircraft carrying further reinforcements; and not to be beaten by the mere scientist, the Air Force gave the Research men who pestered it incessantly with their demands to be consulted and heard, the pet name 'Boffins', while the informal conference at which the Military and Scientific officers wrangled vociferously was named the Sunday Soviet.

The reviewer has one grievance against the author. In the chapter on "Some Memories and Features of T.R.E.," he gives an account, as instructive as it is delightful, of the elaborate precautions they would take to ensure that their Visitors' Days should be impressive. Before being taken round the establishment, the guests would be shown coloured diagrams and training devices displayed in the Office-Room and the Hall of Magic. A selection of these illustrations in the form of a few more plates supplementing the existing seven

plates would have materially added to the attractiveness of the book. A perusal of the book would convince any reader that Mr. A. P. Rowe's efforts in this direction could not but have been distinctive. A printer's error, minor in itself, but likely to confuse some readers intrudes on p. 204 where 'inadequate' is printed where as obviously 'adequate' was meant.

This is a book that has a message of deep import for the scientist and the general public as also for the Civilian and Military Administrative Chiefs. It is to be hoped, in particular, that the Telecommunications Research Laboratory that is to be shortly opened at Jubbulpore will not fail to be benefited by the experiences of the British T.R.E.

R. L. N.

**Velocity Modulated Thermionic Tubes.** By A. H. W. Beck. (Published by the Cambridge University Press), 1948. Pp. x+180. Price 15s. net.

The timely publication of this volume which presents a general introduction and principle of operation of V.M. tubes adds greatly to the fund of scientific knowledge and indicates a great scope of research in this newly developed line. The treatise aims at building up theories from simple postulates and attempts to present a realistic picture of the subject. Suggestions for further scope of work deserve special attention.

Starting with historical introduction and status of V.M. tube art before World War II, the first two chapters devote to the theory of cavity resonators from the standpoint of vibration modes of oscillating mechanical systems, theory of V.M. process for small signal, etc. In Chapter three, calculation procedure for output efficiency of a klystron oscillator as a function of the ratio of starting current to running current has been outlined. Chapter six is an extension of chapter three and presents a large signal theory sufficiently adequate for engineering purposes. The problem of focussing electrons through different types of tunnels is an important feature in klystron design. This is discussed in Chapter four. The fact that coupling of extra resonators to the same beam increases gain much more than that of a simple V.M. power amplifier, induces chapter five to emphasise that the development of multiresonator system will be of great help to the stable frequency microwave communication system. Chapter seven deals with the theoretical aspects of reflex klystron. It is pointed out that though the large dissipation in resonator surface and difficulty of arranging a smooth control of reflector characteristics present a serious handicap for the manufacture of high power reflex klystron, the possibility of obtaining higher frequencies creates a good promise for this type in receiver design. Discussing about the less well known embodiments of V.M. ideas Chapter eight suggests a great scope for research in microwave valve mixers. The interesting discussion presented in Chapter nine about oscillation hysteresis, modulation problems etc., indicates a clue for both theoretical and experimental development. The last chapter presents in a qualitative way the main conside-



ration that should be taken into account when designing a V.M. tube. The example worked out in Appendix 1 on the design of a high power C.W. klystron is highly instructive and helpful. Appendix 2 gives a brief analysis of travelling wave tube which promises to play a great role, especially, where large gain associated with wide band width is desired.

The volume under review like other Modern Radio Technique series publication, will serve as a very useful addition to the existing knowledge of microwave technique. This book is highly recommended to those engaged in microwave research on both fundamental as well as design aspects.

S. K. C.

**The Diary and Sundry Observations of Thomas Alva Edison.** Edited By Dagobert D. Runes. (Philosophical Library, New York), 1948, Pp. 247. Price \$ 4.75.

The selections from the notes, statements and observations of Thomas Alva Edison, which comprise this handy volume of 240 pages, bring out the personality and greatness of "one of the world's greatest benefactors", who initiated the electro-industrial era of our time. There is perhaps no one who has passed through a school that has not read or heard of Edison. While not a few of the thousand inventions which bear the impress of his skill and ingenuity are widely known and their benefits widely enjoyed, the knowledge relating to the man himself, his life and work, is not widespread. The Editor of the collection must be congratulated for bringing together representative selections from his numerous writings, which give a glimpse of his personality, and for making them available to the general reader.

In the book under review, the reader is taken through "a fascinating trip into the unknown as it were," and provided an opportunity to witness the working of the ever alert, eminently practical mind of an experimenter deliberately searching out new paths and new ways into the mysteries of nature. The inventions of Edison are not the results of brain waves; they were products of intense thinking and systematic experimentation. He was entirely self-made and self-educated. He did not hold any sinecure jobs with fat emoluments. He was drawn into experimenting and inventing inevitably as it were by the sort of discipline which he chose to give himself. He had no illusions about the lot of the inventor.

This is what he says about the inventor:—"The inventor tries to meet the demand of a crazy civilization. Society is never prepared to receive any invention. Every new thing is resisted, and it takes years for the inventor to get people to listen to him and years more before it can be introduced, and when it is introduced our beautiful laws and court procedure are used by predatory commercialism to ruin the inventor. They don't leave him even enough to start a new invention." This was the lot he chose for himself, and his whole life is an object lesson in plain living and high thinking.

The Diary, covering 59 pages, gives a glimpse of Edison's daily life. His reading was voracious. He would read fiction and immediately switch on to the study of a journal of higher mathematics. His prescription for steady nerves was the study of *Encyclopædia Britannica*. He read New York World for his mental breakfast and glanced through accounts of murders "to keep him in touch with human affairs." He read Goethe to lull him to sleep. When he entered a book shop he found a thousand books that he wished to read. He did not read just a few books but read whole libraries. "Almost any book will supply entertainment or instruction," he says. He was deaf but he was not only not overpowered by his deafness, but he deliberately planned to develop the other gifts with which he was endowed. The deafness, for instance, did not prevent him from hearing the clicking of a telegraph instrument when he was near it, as an operator always must be. In fact, his deafness proved to be an advantage; it made him immune to the outside distracting noises. He was cut off from "that particular kind of social intercourse which is small talk", and thereby found freedom to think out his problems. "The things that I have needed to hear, I have always heard," he says and continues "Most of the nerve strain of our modern life, I found, comes to us through our ears". To him Broadway was a peaceful thoroughfare. His inventions made it possible to build a world "in which the person who is deaf will have a definite advantage". Here is a personality, who not depressed by the loss of hearing, turns it into a positive asset. It illustrates in a most eloquent manner, Edison's outlook on life, and no wonder, his life was full of achievement.

There are in Edison's writings, many tracts of wisdom, many correctives for man's failings and weaknesses, and many suggestions for educationists and social workers. His optimism in the future prosperity and greatness of America is robust. Educational developments, he believes, will help in raising a better and progressive generation of citizens and parents, leaders, scientists and business managers. Whatever he writes, whether it relates to ethics or education, music or philosophy, is direct, clear and precise, revealing a master expounding his thesis in a simple and lucid language. This is a book which every one ought to read. There is much in it that is original thought-provoking and instructive. There are few books to compare with it which can be read with both pleasure and profit.

B. N. SASTRI.

**Animals Alive.** By Austin H. Clark. (D. Van Nostrand Co. Inc., New York, Macmillan & Co. Ltd., London), 1948. Pp. viii+472. Price \$4.00. Sterling Price 22s. net.

Considering that Zoology is a serious subject, the book under review which deals with the Animal Kingdom as a whole in relation to man and his physical universe is a welcome addition to our general or natural history Libraries.

The test of popularity of any serious publication does not lie merely in the number of copies sold or in the number of editions it has gone through or in its moderate price, but in the avidity and zest with which an average reader can return to it again and again. Judged by this test, "Animals Alive" ought to prove a good seller and have an appeal to the lay general reader as well as to the specialist. Zoology, as presented in text-books, is not usually a subject that can have a universal appeal. Not all serious students of Zoology would care to read a text-book more than once were it not for the fact that there is usually an examination to pass. While "Animals Alive" reads like a novel, it is in fact a general text-book of Zoology shorn of its annoying and difficult technical terms in Latin and the irksome and uninteresting details of structure and function.

The purpose of this publication, as stated by the author himself in the preface, is to answer in an intelligible way questions which may arise in the mind of the general reader without special technical knowledge in reference to the relationship of the animal world to man and of the various types of animals to one another and to the plants and their physical environment on land and water, and the relationship of the living world to our universe as a whole.

The book is divided into four parts. The first part deals with man and the animal world, the second with land animals, the third with freshwater animals, and the fourth with life in the sea. Each part is divided into a number of chapters the longest of which does not exceed 20 pages and the shortest does not fall below 4 pages, the average length of a chapter for the whole book being eleven pages. Brevity of chapters is an advantage to the slow and deliberate reader who desires to enjoy as he unconsciously assimilates. It stimulates without tiring the reader.

Within the space available for a review of this kind it will not be possible to touch upon anything but a fraction of all the interesting details of animal life with which the book is packed. The association of man with the animal world has a long historic background, and "a true understanding of the latter is not possible without, first of all, a somewhat detailed appreciation of man's most intimate contacts with it, especially with those numerous and varied types which have been brought under domestication and those more numerous and more varied types against the depredations and attacks of which he must be constantly on guard." The number of domesticated animals which have descended from ancestors of Asiatic origin seems to be unexpectedly large. The dog, the horse, the sheep and goats, the pig, the humped cattle and the yak, the camel and the elephant, the barn-yard fowl and geese, the pigeon and the peacock, all appear to have such origin.

The chapters dealing with animals of all classes which are of some importance to man or are obnoxious to him or his domesticated animals are by far the most interesting and make reference to the honey bee, the silk worm, the lac insect which derives its name from *lakh* with its Sanskrit derivative "laksha" from the fact that they are abundant wherever found, the

fur-bearing land animals, and the sea animals which provide him with food and other economic products. These chapters are literally packed with rare and interesting observations, a few of which may be mentioned here: Mosquitoes occur in the Arctic regions in millions, while some feed on gorged bed-bugs and suck blood from the backs of turtles. The mosquito-fly or human bot-fly is known to attach its eggs to a female mosquito to enable the little maggots to enter into the puncture made in man or mammals by the mosquito where it lives until fully grown and ready to pupate in moist soil. Very few would fail to be surprised to know that there are insect predators which chew metal or minerals in the same way as our sophisticated moderns chew gum, omnivorous saw-toothed grain beetles which do not scorn to live and breed in red pepper or chillies, bore into cigars and cigarettes, and eat snuff.

Chapters 7 & 8 of Part I contain some of the most interesting and weird facts about the food and feeding habits of man and animals in various parts of the world. It would be shocking to the most refined and confirmed non-vegetarian in India, peopled by innumerable primitive tribes with a wide range of animal menu to their credit, to learn that the skin of certain whales, the stomach contents of the Greenland reindeer, the dried grasshoppers, the luscious queens of Indian termites, the pickled beetle grubs of Mexico, the pupae of silk-worm moths and even the baked centipedes of Polynesia are considered delicacies by some people in some parts of the world.

Apart from finned, hoofed and winged animals of all kinds on land and water, man has included in his dietary a great variety of the lesser known vertebrates and invertebrates. Among the vertebrates may be mentioned the tapirs, ant-eaters and sloths, porcupines and armadillos, pumas and monkeys, bats, the large, reptiles like the iguanas, crocodiles, sea and land-snakes, and the salamander. Even the lancelets and sea-squirrels which are considered distant relations of vertebrates are fished for food in China Seas and the Mediterranean Seas respectively. Among the invertebrates are the squids, sea-urchins, bristle and other sea-worms, barnacles, jelly-fishes, and sea-anemones. We have the testimony of the author himself who has had the courage to verify that the claims as to taste and nutritive value made for some, at any rate, of the formidable array of food items mentioned in the book, are not exaggerated. The author has also marshalled facts to prove the truth of the saying "one man's food is another man's poison", and to show that there can be no death from starvation in many parts of the world if only the human palate can be educated to relish the wide range of dietary provided by nature.

An appendix is provided at the end of the fourth part dealing with the classification of animals as under: 1. bilateral symmetry, 2. animals with mixed symmetry (bilaterally modified by more or less evident radial symmetry, often most obvious in the nerves), 3. animals with radial symmetry, 4. unorganised animals, 5. singlecelled animals. There is an unusually good index covering 37 pages

but unfortunately this does not include the alliterative *onomatopœia* on p. 48 which no standard English dictionary explains.

The book is illustrated with clear black and white drawings of examples of most groups of animals dealt with in the book. One wishes that the feeding of the African caterpillar described on p. 131, and the S. American *Mata-mata* referred to on p. 218 had been figured.

The reference to the food-collecting mechanism of the sponges and to the boring habits of some sponges does not seem to accord with the classification of the Sponges as an unorganised group and with the more or less accepted view that Sponges constitute a separate sub-kingdom (Parazoa) equal in rank to that of the Protozoa or the Metazoa.

The freshwater jelly-fish, *Limnocnida* common to Africa, India and China, to which no reference is made, seems to be better known in S. Eastern Asia than *Microhydra*. What has been stated about the breeding of the Indian elephant is generally true, but it may interest readers to know that one or two cases of domesticated Indian elephants breeding in the Andaman islands are recorded.

The excellence of the paper, printing and get-up of the book is somewhat marred by a number of printer's errors on thirteen pages (Pp. 3, 15, 69, 78, 128, 316, 362, 379, 384, 400, 429, 432, 433). It is hoped that in reprinting this excellent and readable book on Zoology the publishers will rectify the errors and endeavour to maintain the reputation of the publishing trade in U.S.A.

Notwithstanding the few errors of commission and omission no general or specialist library in India can do without this book on its shelves.

H. S. R.

**Oncidium.** By P. R. Awati and K. R. Karandikar (Zoological Memoirs<sup>1</sup> The University of Bombay), 1948. Pp. 53. Price Rs. 3.

From Lucknow, a series of memoirs on Indian animal types was being published with the object of familiarising the zoology students of Indian Universities with Indian examples. The Lucknow editors have not yet exhausted the list of specimens they drew up to describe when the University of Bombay has projected a memoir on *Oncidium* with the same object of putting before the students of zoology, particularly that of Bombay University, descriptions of Indian types. While we welcome correct and comprehensive accounts of as many Indian examples as possible, we only hope that there will be no duplications.

The memoir, under review, deals with the anatomy, bionomics and embryology of the marine pulmonate slug, *Oncidium*. The systematics of the example are described in Section A and unfortunately nowhere do we learn the name of the founder of the genus or of the species of *Oncidium*.

Section B deals with external morphology. It would have been excellent if the publishers had reproduced Figures 1 and 2 as plates or even better, if the authors had given a coloured plate or plates, indicating suitably the size of the animal drawn.

In describing the histology of the radular support, the authors refer to a cellular body of polygonal cells with nuclei. A discussion of the nature of this tissue would have been most welcome.

In Figs. 7 and 21 the opening of the hepatic ducts are described as 'Liver openings' and 'opening of the Liver-gland' respectively. The authors themselves refer to three hepatic ducts on page 23, and instead of leaving the student in doubt, they could have clearly indicated in the figures, the openings as those of hepatic ducts.

The 'cell membranes' are noted to be not discernible in the pulmonary tissue. If the cell outlines are not seen even under high power of the microscope, it is not discussed if the syncytial tissue is helpful in gaseous exchange. The student will be anxious to know how the animal inhales air and the mechanics of respiration which is not described in any text-book may, therefore, have been given in detail.

The ventricle is described as 'thickly set muscular organ' and also that 'its inside is filled with muscle-bands....' The description would have been better understood if these bands were incorporated in Fig. 35.

In a number of places in the text, a reference is made to 'body cavity' and the student will be able to comprehend better, if a connected account of the hæmocœl and hæmocœlic canals or sinuses and the coelom was given, like all other systems, separately.

The early cell-history during development is described but the nature of the yolk content and of cleavage are not included. At any rate, figure 55 shows four unequal micromeres derived from four equal blastomeres.

The get-up of the book leaves much to be desired. References are frequently misquoted, (page 4, 40 Watson, 1926; page 6, 14 Plate, 1892) or completely omitted (Berge, 1882). The reference list on page 53 could have been arranged with greater care. A few of the devils amongst others, are given below which could have been easily avoided: p. 4, medium for median; p. 14, cartilagenous for cartilaginous; p. 26, diaphragm for diaphragm; p. 53, Harvard for Harvard, and Joyeux-Laffuie is written in at least three different ways (p. 12; 50).

The usefulness of the memoir could have been considerably heightened if these shortcomings had been envisaged particularly as it is meant for the students.

L. S. R.

**Mysore Geological Department Records, XLIV, (1948).**

The Director Mr. B. Ramarao summarises in the first article, the activities of the Department for the year 1945 wherein statistics of the production of minerals both by the department and private agencies with their values are recorded. The Mysore Geological Department have been pioneers in the country in taking up utilisation and prospecting work as supplement to their survey work and their activities as recorded by the Director, serve as an example to the other Geological Surveys in India and States.

In the second Chapter Mr. B. Ramarao contributes a paper on gold investigations in Mysore and gives an excellent summary of the gold mining activities, and more particularly of the recent and current attempts of the Geological Department to reopen some of the ancient mines. In a diagrammatic representation showing the percentages of gold production of each of the principal producing countries in the year 1940 it is shown that Africa produced about 41% of gold. Europe about 12%, Asia about 9% (of which India's share is 0.7%), Australia about 6%, Central America about 5% and North America about 27%. Almost all the gold produced in India goes to the credit of Mysore State. An excellent case has been made out in this paper for extending prospecting operations to other promising areas not only in the State but also in other parts of India.

Mr. Lakshmana Rao's paper on the road metals and lesser minerals details suitable quarry sites for building material and road material and on the occurrence of some economic minerals like lime kunkur, clays, corundum, quartz and felspar.

Mr. M. B. Ramachandra Rao's contribution on 'Geophysical Prospecting for Graphite' has a negative value in that it finds that the results of geophysical prospecting give no indications of workable deposits. Mysore Geological Survey Department also leads the rest of India in having introduced geophysical methods for engineering and prospecting problems and Mr. Ramachandra Rao has already a fine record of work to his credit in Mysore and elsewhere in this direction.

The last paper is a 'Note on Bowenite and Talc picrolite from 'Holinarsapur area' by Mr. Tirumalachar.

This record, suitably illustrated by diagrams, maps, and plates keeps up the traditions of the publications of the Mysore Geological Survey Department.

C. MAHADEVAN.

**Eradication of Water-Hyacinth and Production of Compost Manure.** By Megh Nath Basak. (Brochure issued by the Directorate of Agriculture, Government of West Bengal).

In this brochure, Mr. Basak has drawn attention to the urgent necessity of securing complete eradication of water-hyacinth from the Provinces of Bengal and Assam. Not only has the extensive occurrence of water-hyacinth rendered navigation in many parts of the Provinces hazardous, and affected agriculture, a conservative estimate placing the annual loss of deep-water paddy due to deprecation by the weed at eleven crores of rupees, but also has raised acute problems of water pollution and public health.

Various methods suggested, in the past, for eradication of the pest have, in practice, not been successful owing to the heavy financial burden they involve. The manufacture of different substances, such as starch, fibre, paper-pulp, etc., from water-hyacinth has also not proved economically feasible.

During 1946, composting of hyacinth, by improvising Dr. Acharya's 'Bangalore' Method to suit local conditions, was carried out at selected centres in Bengal under the supervision of Mr. Basak. In the light of experience gained then, he has advocated production of compost from hyacinth all over the Provinces as a means of eradicating the pest, at the same time securing a valuable manure. Extensive data have been cited to show that the sale of the composts produced would more than compensate the cost of the production.

While further information regarding the extent by which incidence of the pest has been brought down in the areas where composting was carried out in 1946, and also regarding the response of crops to hyacinth-composts, would have been particularly useful, the publication of the pamphlet is to be welcomed as showing a way of tackling the problem. Success in this direction lies in a concentrated effort by the Governments and Public Organisations, no less than by private agriculturists.

C. R. H.

#### INDIAN STANDARDS INSTITUTION CHEMICAL DIVISION

**MORE** than one hundred and ten chemical manufactures have already been referred for purposes of standardisation to the Chemical Division Council of ISI, which was inaugurated today in New Delhi by the Hon'ble Dr. Syama Prasad Mookherjee, Minister for Industry and Supply.

The Council on which all the units of chemical industry in India are represented has elected Dr. H. L. Roy of the College of Engineering and Technology, Jadavpur (Bengal) as Chairman.

Pointing out the fact that Indian industry had offered maximum co-operation with the Indian Standards Institution in all its aspects of work, the Hon'ble Dr. Mookherjee observed that while the Government realised their ultimate responsibility in respect of legislation for enforcing standards, industry's helpful attitude in this matter proved that, meanwhile standards could be fixed and enforced by

mutual co-operation between the Government and industry. The establishment of the Chemical Division could help to raise the standard of production, he said, not only in the chemical industries themselves but in all those other industries which depended on the utilisation of chemicals.

It was pointed out at the meeting of the Council that besides the 110 odd subjects proposed by members of ISI for the attention of the Chemical Division, the latter was also interested in the work of the International Standards Organisation relating to a number of items such as petroleum products, varnishes, paints, etc., rubber, plastics and general definitions relating to Chemical and Physical Test Results. The Chemical Division will take over the organisation of the secretariat for the International Standards Organisation's Committee for Shellac.



## SCIENCE NOTES AND NEWS

### Constitution of Phenyl Thiourea

Rameshwar Dayal Gupta Chemical Laboratories, Birla College, Pilani (Jaipur), has asked us to announce that:—

"Work is being carried out in his laboratory for the elucidation of the constitution of Phenyl-thiourea by electrometric means. The titration curves have indicated two well-defined inflexion points establishing its acidic nature and the existence of two dissociation constants."

### Freezing the Earth to Mine Coal

According to British Information Services (issued by the office of the U.K. High Commissioner in India), British Mining Engineers are freezing a portion of the ground near Calverton, in Nottinghamshire, in order to sink a new pit for mining coal. The freezing of the ground to a depth of 412 feet is necessary to seal off the underground water in the porous sandstone through which the colliery shaft has to be sunk. If this were not done, there would be a flooding of the ground water into the shaft at the rate of 1,000 gallons per minute.

The freezing is said to be accomplished by driving 25 pipes in a circle through the sandstone and circulating brine cooled to 37° below freezing point. A suitable refrigeration plant has been installed. It is expected that in two months, a long cylinder of ice will have been formed and the actual sinking of the shaft will then be undertaken. The proposed output of coal in this virgin field is estimated at 1 million tons a year.

M. B. R. Rao.

### Allocation of Radio-Active Isotopes

A committee to decide priorities in allocating radio-active and stable (non-radio-active) isotopes has now been set up in Britain under the chairmanship of Sir John D. Cockroft, Director of the Ministry of Supply's Atomic Energy Research Establishment at Harwell.

"Gleap", the low energy pile at Harwell, is already providing limited quantities of radio-active isotopes and facilities for experimental workers and arrangements have been made to buy U.S. and Canadian radio-active isotopes to supplement these supplies until the large pile at Harwell is operating at full power probably early next year.

Persons requiring isotopes must have their requests sponsored by the Medical Research Council, the Agricultural Research Council or the Department of Scientific and Industrial Research whose representatives are members of the newly-appointed Committee.

At present the radio-active isotopes from Harwell are being distributed directly to the customer. Where production involves chemical extraction or where processing or synthetic work is necessary, the work will ultimately

be carried out at the Ministry of Supply Radio-chemical Centre at Amersham.

Radio-active elements are daily coming into more extensive use for industrial, agricultural, medical and general scientific research. One of the most useful of these is phosphorus which after being "cooked" in an atomic pile becomes radio-active and can be used to trace disease in men, animals and plants and to detect flaws in steel among other purposes.

### Committee to Review Patent Laws

The Government of India have set up an Enquiry Committee to review the patent laws in India, with Bakshi Sir Tek Chand, Retired High Court Judge and Member, Constituent Assembly of India, as Chairman.

Dewan Bahadur K. Rama Pai, Retired Controller of Patents and Designs, will act as Member-Secretary to the Committee. The terms of reference to the Committee are as follows:—

1. To survey and report on the working of the Patent System in India.
2. To examine the existing Patent legislation in India and to make recommendations for improving it, particularly with reference to the provisions concerned with the prevention of abuse of patent rights.
3. To consider whether any special restrictions should be imposed on patents regarding food and medicine.
4. To suggest steps for ensuring effective publicity to the patent system and to patent literature, particularly as regards patents obtained by Indian inventors.
5. To consider the necessity and feasibility of setting up a National Patents Trust.
6. To consider the desirability or otherwise of regulating the profession of patent agents.
7. To examine the working of the Patent Office and the services rendered by it to the public and make suitable recommendations for improvements. And
8. To report generally on any improvement that the Committee thinks fit to recommend for enabling the Indian Patent System to be more conducive to national interest, by encouraging invention and the commercial development and use of inventions.

It is expected that the Committee will start its work at an early date with New Delhi as its Headquarters. It will visit such places as it may consider necessary and will take evidence on questions arising from the terms of reference.

Persons who desire to be called as witnesses should apply in writing to the Secretary of the Committee, C/o Ministry of Industry and Supply, Government of India, New Delhi, giving their full names and addresses, together with a brief memorandum of the points in regard to which they desire to give evidence.



**Professor Marcus L. Oliphant**

The world famous Australian-born atomic scientist has been appointed Director of the Research School of Physical Sciences at the Australian National University at Canberra, according to an announcement by the Vice-Chancellor of the University, Prof. Copland.

Prof. Oliphant is at present Professor of Physics and Director of the Department of Physics at the University of Birmingham. It may be several years before he can take up the Australian appointment, but in the meantime he will advise the Interim Council of the university on the organization of the new physical science laboratory and its equipment.

A Birmingham colleague of Prof. Oliphant has been appointed Chief Technical Officer. He will come to Australia next year.

**FAO Office for Asia and the Far East**

The Food and Agriculture Organization of the United Nations announced today that an FAO regional office for Asia and the Far East will be established in Bangkok in the near future and will be in full operation early in 1949.

The FAO Regional Representative for Asia and the Far East will be W.H. Cummings, a United States citizen born in Burma. Mr. Cummings, who is now in Asia, will go to Bangkok soon to make arrangements for opening his office there and for recruiting clerical and administrative officers. These, in so far as possible, will be drawn from within the region. Such technical officers as are required will be assigned from FAO headquarters.

The office at Bangkok, FAO said, will maintain close liaison with headquarters of the United Nations Economic Commission for Asia and the Far East at Shanghai and with other regional offices which may be set up by United Nations organizations.

With the establishment of the Bangkok office, FAO will have three regional offices in operation—at Rome, serving Europe; at Cairo, serving the Near East; and at Bangkok. Plans for developing FAO regional representation for Latin America are already well advanced.

**Zoological Survey of India**

In April 1942 the Zoological Survey of India was temporarily transferred to Benares from its original headquarters at the Indian Museum, Calcutta, as a war measure. As a result of the decision of the Government of India to retransfer this department to Calcutta this year, a large part of the zoological collections has already been shifted to Calcutta. It is expected that the transfer will be completed by the beginning of 1949.

From January 1, 1949, the address of Zoological Survey of India will be: "Janakusum House," 34, Chittaranjan Avenue, Calcutta.

**Dr. B. R. Seth**

Dr. B. R. Seth of the University of Delhi has been invited as Visiting Professor of Applied Mathematics for the year 1949 in the University of Iowa, U.S.A., and will be in residence from January, 49 to December 49, at the Iowa State College, Ames, U.S.A.

Dr. Seth also attended the Seventh International Congress of Pure and Applied Mechanics held in London during September 1948 as an Indian delegate.

**Botanical Society of Bengal**

The Honorary Secretary, Botanical Society of Bengal has asked us to announce the following:—

"A half-yearly list of Botanical papers printed in India, Pakistan, Burma, Ceylon, Siam, Malaya and Indonesia will be published by the Botanical Society of Bengal in the Society's Bulletin issued in April and October every year. Authors are requested to kindly send their reprints to the Honorary Secretary, Botanical Society of Bengal, 35, Ballygunj Circular Road, Calcutta 19, to facilitate this compilation work."

**I. C. S. U.**

We are glad to announce that the following 10 Scientific Unions have federated themselves into the International Council of Scientific Unions.

**I.A.U.**—International Astronomical Union.—General Secretary: Prof. J. H. Oort, Sterrewacht, Leiden, Netherlands.

**I.U.B.S.**—International Union of Biological Sciences.—General Secretary: Prof. P. Vaysiere, Museum National d'Histoire Naturelle 57, rue Cuvier, Paris V.

**I.U.C.**—International Union of Chemistry.—General Secretary: Prof. R. Delaby, Ecole de Pharmacie, 4, Avenue de l'Observatoire, Paris VI.

**I.U.Cr.**—International Union of Crystallography.—General Secretary: Dr. R. C. Evans, Crystallographic Laboratory Free School Lane, University of Cambridge, England.

**U.G.G.I.**—Union Geodesique et Geophysique Internationale.—General Secretary: Dr. J. M. Stagg, Kew Observatory, Richmond Surrey, England.

**U.G.I.**—Union Geographique Internationale.—General Secretary: Mlle M. A. Lefevre, Institut Geographique Paul Michotte 2, rue des Doyens, Louvain, Belgium.

**U.I.H.S.**—Union Internationale d'Histoire des Sciences.—General Secretary: Prof. P. Sergescu, 7, rue Daubenton, Paris V.

**I.U.P.A.M.**—International Union of Pure and Applied Mechanics.—General Secretary: Prof. J. M. Burgers, van Houtenstraat 1, Delft, Netherlands.

**I.U.P.A.P.**—International Union of Pure and Applied Physics.—General Secretary: Prof. P. Fleury, Institut d'Optique, 3, Bld. Pasteur, Paris XV.

**U.R.S.I.**—Union Radio-Scientifique Internationale.—General Secretary: Col. A. Dorsimont, 42, rue des Minimes, Bruxelles.

**FRESH STOCK  
OF  
Chemicals & Other  
Laboratory Requisites**

*FOR*

Chemical & Pharmaceutical Works.  
Sugar & Cement Factories.  
Schools & Colleges.  
Textile Mills & Dye Works.  
Soap, Rubber & Oil Mills  
Hospital Laboratories.

*Latest Price List from*

**THE  
Unique Trading  
Corporation**

**51-53, New Hanuman Lane  
BOMBAY 2**

Grams: UNILAB.

**THE  
MYSORE CHEMICALS & FERTILISERS, LTD.**

REGISTERED OFFICES:  
1129, VANI VILAS ROAD, MYSORE

TELEGRAMS: "CHEMI"  
TELEPHONE NO. 243

**WORKS: BELAGULA  
(MYSORE STATE RAILWAY)**  
TELEPHONE NO. 435

**ON THE WAY TO BRINDAVAN GARDENS  
(KRISHNARAJASAGAR)**

*Manufacturers of:*

Concentrated and Fuming Sulphuric,  
Hydrochloric, Nitric and Chlorosulphonic  
Acids; Ammonia, Ammonium Carbo-  
nate and Ammonium Sulphate; Sodium  
Sulphate; Copper Sulphate; Ferrous Sul-  
phate; Ferric Chloride; Superphosphates  
and Mixed Fertilisers, etc.

**IMPORTANT**

Scarcity of materials is being felt in every field of  
work; but by our ceaseless efforts we have collected  
large stocks of scientific goods and we are in a  
position to satisfy demands from consumers of these  
goods.

Please send your enquiries and orders for anything  
in the line of Physical, Chemical and Biological  
Apparatus, Gas and Water fittings, Glass graduates  
and Hollow glassware, Barometers, Colaroids,  
Colorimeters, Pehameters, Ether, Acids, Chemicals  
and Reagents, etc., etc., to us.

We assure you of the promptest attention.

**Bengal Chemical and Pharmaceutical Works, Ltd.**  
**CALCUTTA - - BOMBAY**

## INDIAN COUNCIL OF AGRICULTURAL RESEARCH KHETI

A monthly Hindi Journal devoted to the publication of original articles of practical interest and vital importance to the farmers, landowners, rural development workers, co-operative societies, libraries, etc. Gives most up-to-date information regarding latest developments and improvements in the fields of Agriculture and Animal Husbandry.

**An ideal monthly magazine for the layman**

**Annual Subscription Rs. 6      Single copy As. 8**

### INDIAN FARMING

**A Popular Monthly Magazine for the Public**

Features of the Magazine include original articles of practical interest to farmers, what the scientists are doing, what's doing in all-India, you ask we answer, etc. Of special interest to farmers, landowners, rural development workers, co-operative societies, government officials, clubs, libraries and college students.

**Annual Subscription Rs. 6      Single copy As. 8**

### INDIAN JOURNAL OF AGRICULTURAL SCIENCE

**Quarterly:** A journal dealing with agriculture and allied sciences. Mainly devoted to the publication of the results of research and field experiments.

### INDIAN JOURNAL OF VETERINARY SCIENCE AND ANIMAL HUSBANDRY

**Quarterly:** A journal dealing with Animal Husbandry and Veterinary Science and allied sciences. Mainly devoted to the publication of scientific research relating to health, nutrition and breeding of livestock.

**Annual Subscription Rs. 6      Per copy Rs. 2**

To be had of

**MANAGER OF PUBLICATIONS**  
CIVIL LINES, DELHI

## JOURNAL OF SCIENTIFIC & INDUSTRIAL RESEARCH

### A Monthly Journal

**Devoted to the Progress of Applied Research**

**ANNUAL SUBSCRIPTION: Rs. 9; SINGLE COPY: Re. 1**

#### Schedule of Advertisement Charges

	Full page		Half page	
12 Insertions	Rs. 360	£ 30	Rs. 200	£ 16-12
6 Insertions	Rs. 200	£ 16-12	Rs. 120	£ 10
1 Insertion	Rs. 35	£ 3	Rs. 20	£ 1-12

#### Favoured Positions (12 Insertions Only)

Facing Contents Page	Rs. 400	£ 33-4
Facing Editorial Page	Rs. 400	£ 33-4
3rd Cover Page	Rs. 450	£ 37-4
4th Cover Page	Rs. 500	£ 41-4

**Only Full Page Advertisements are Accepted for the Above Positions.**

**Advertisements in Colours: Rs. 15 (£ 1-4) Extra**

per Page per Colour. Only Full Page Advertisements are Accepted in Colours

**For particulars, apply to:**

**THE EDITOR**

**Journal of Scientific and Industrial Research**

The Mall, Civil Lines

**DELHI**

# ACTA CHEMICA SCANDINAVICA

Published by Chemical Societies in Denmark, Finland, Norway and Sweden



## Editorial Committees :

- Denmark:** J. A. Christiansen (Pres.), N. Bjerrum, S. K. Hagen, K. A. Jensen, A. Langseth, K. Linderstrom-Lang, K. J. Pedersen.
- Finland:** A. I. Virtanen (Pres.), K. Buch, P. Ekwall, S. Kilpi, N. J. Toivonen, E. Tommila.
- Norway:** O. Hassel (Pres.), A. Folling, M. G. Raeder, N. A. Sorensen.
- Sweden:** K. Myrback (Pres.), H. Erdtman, J. A. Hedvall, L. Smith, The Svedberg, H. Theorell, A. Tiselius.

Acta Chemica Scandinavica publishes the majority of Scientific work in general, physical, inorganic, organic chemistry and biochemistry carried out in Denmark, Finland, Norway and Sweden. 10 issues are published annually. The yearly volume contains about 1200 pages.

**Annual subscription :** \$ 8.50 + postage. Orders should be placed with Einar Munksgaard, Norregade 6, Copenhagen, Denmark, or any bookseller all over the world.

**Editor-in-chief:** Professor Karl Myrback, Biokemiska Institute, Stockholm 6, Sweden.  
**Executive Secretary:** Fil. lic. Hakan Winberg, R 551, Sodertalje, Sweden.

## Current Science

MALLESWARAM P.O., BANGALORE, INDIA

The premier Science Monthly of India devoted to the publication of the latest advances in pure and applied sciences.

*The Journal is conducted by the*

**CURRENT SCIENCE ASSOCIATION**

with the Editorial Co-operation of Eminent Scientists in India

(Annual Subscription : Rs. 6 India  
Rs. 8 or sh. 12 Foreign)

Orders may be placed with :

**The Secretary, Current Science Association, Malleswaram P.O., Bangalore**

### ADVERTISEMENT TARIFF

Ordinary pages	(per insertion)	Special positions	(per insertion)
Full Page	Rs. 50 £ 4	Front Cover	Rs. 75 £ 6
		Back Cover	75 £ 6
Half Page	„ 28 £ 2-5	Facing Editorial	75 £ 6
		Inside Cover	60 £ 5
Quarter Page	„ 16 £ 1-6	Facing Science Notes	60 £ 5

P.S.—Advertisement Charges are Payable in Advance.



## SCRIPTA MATHEMATICA PUBLICATIONS

1. **SCRIPTA MATHEMATICA**, a quarterly journal devoted to the history and philosophy of Mathematics. Subscription \$ 3.00 per year.

2. **SCRIPTA MATHEMATICA LIBRARY**. 1. Poetry of Mathematics and Other Essays, by *David Eugene Smith*. 2. Mathematics and the Question of Cosmic Mind, by *Cassius Jackson Keyser*. 3. Scripta Mathematica Forum Lectures, by distinguished mathematicians and philosophers. 4. Fabre and Mathematics and other Essays, by *Lao G. Simons*. 5. Golois Lectures, by Professors *Douglas, Keyser, Franklin and Infeld*. Price of each volume, in a beautiful silver-stamped cloth edition \$ 1.25.

3. **PORTRAITS OF MATHEMATICIANS, PHILOSOPHERS AND SCIENTISTS** with biographies, in three beautiful Portfolios. Price of each Portfolio \$ 3.75. Price of the set of 3 Portfolios (37 portraits and biographies) \$ 10.00.

4. **VISUAL AIDS IN THE TEACHING OF MATHEMATICS**. Single portraits, mathematical themes in design, interesting curves and other pictorial items. List on request.

## SCRIPTA MATHEMATICA

YESHIVA COLLEGE

Amsterdam Avenue and 186th Street, New York, 33  
NEW YORK

## International Commission of Agricultural Industries

18, avenue de Villars. PARIS VIIe, France

51, route de Frontene. GENEVE, Suisse

60 East, 2nd Street. NEW-YORK 17, U.S.A.

Specialized in the studies and classification of all questions interesting agricultural, food and biological Industries, and also industrial plant growing, the **International Commission of Agricultural Industries** owns in Paris an International Centre of Documentation at the disposal of anyone interested in these questions. This Centre has the possibility either to supply the necessary photographic copies (photostats), microfilm copies, etc., or to undertake any documentary research desired. It has also an important "Catalogue Documentation" concerning the equipments and material employed in the field of Agriculture and its Industries.

Every month, the International Commission of Agricultural Industries publishes:

### "The International Review of Agricultural Industries"

Analytical Edition—containing thousands of brief analyses, in French language, of the principal studies on industrial plant growing, agricultural, biological and food industries published over the world, either in periodicals or books.

### "The International Review of Agricultural Industries"

Bibliographic Edition, listing, in their original language, summaries classified in more than one thousand of the specialized periodicals of all countries, as well as nomenclatures of the most important books concerning the abovementioned subjects.

### "The Analytical Bulletin of French Patents"

referring to Agriculture and Agricultural Industries.

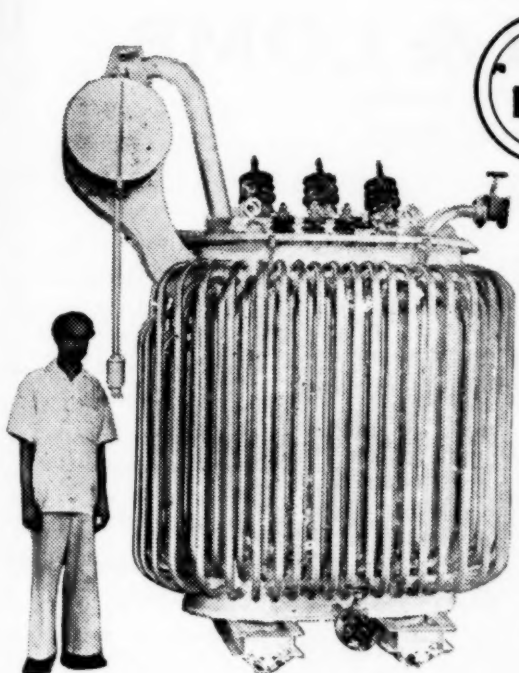
### Annual Subscription :

**International Review of Agricultural Industries, Analytical Edition—U.S.A. \$ 10**

**International Review of Agricultural Industries, Bibliographic Edition—U.S.A. \$6**

**Analytical Bulletin of French Patents**

**—U.S.A. \$10**



# **MYSORE**

## **TRANSFORMERS.**

1. Low Magnetic & Current Loadings.
2. Robust Mechanical Construction.
3. Every Modern Feature Incorporated.
4. Inspection by Trained and Qualified Staff at Every Stage of Construction.
5. Every Unit Tested Fully.
6. Guarantee of Free Service for the First Year of Operation.
7. All Units to B.S. Specifications.
8. Any Special Requirements or Design Changes can be incorporated on demand.

*Units up to 5,000 K.V.A. 33 K.V.*

Suppliers to the Government of Mysore for the past 14 years. Over 200 satisfied customers.

**You get more for your money from  
State-owned Industries**

# **GOVT. ELECTRIC FACTORY**

**MYSORE ROAD**

- - -

**BANGALORE CITY**

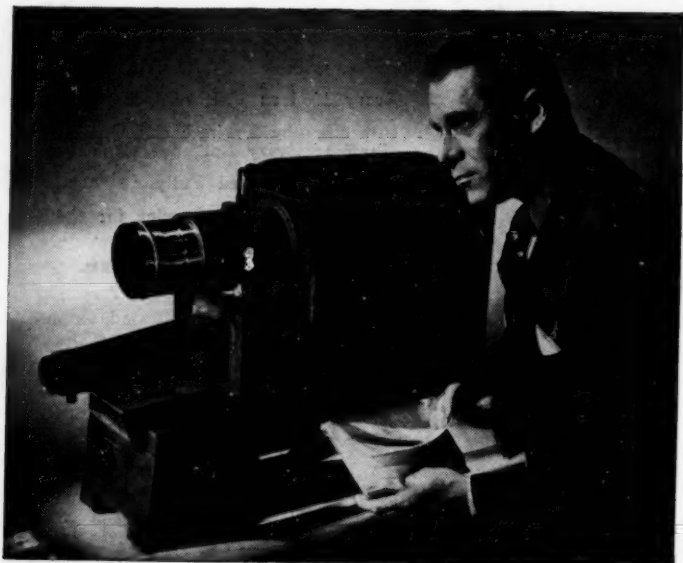
---

# American **BAUSCH & LOMB**

## **BALOPTICONS (Still Projectors)**

Are designed for greater convenience and approach nearest to the mark of perfection in modern Visual Aids to Education.

Balopticon Model LRM-18 is a favourite instrument with institutions, satisfying a host of educational needs; it will project slides, books, maps, photographs, botanical or geological specimens and other solid objects.



*Some features:—*

**It is combined Slide and  
Opaque Projector.**

**Illumination for the two  
types of projection well-  
balanced to avoid eye-  
strain.**

**Screen images sharp  
and brilliant.**

**Projection distances up  
to 25 or 30 feet.**

**Has built in Motor  
Blower Cooling system.**

**Easy to operate; gives  
long trouble-free service.**

**It is economical; uses  
only one 230-volt/500-  
watt bulb.**

**For longer projection distances ask for  
particulars of Balopticon Model CR-25**

*Sole Agents:*

# **MARTIN & HARRIS LTD.**

**(Scientific Dept.)**

**Savoy Chambers, Wallace Street**

**BOMBAY-1**